# Municipal Engineering

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## Turbine Pumping Units in the Indianapolis Water Works

**Editorial Correspondence**

THE city of Indianapolis is supplied by direct pumpage through a common distribution system from two stations which derive their supply from White river through a canal. This canal starts at a point above a dam located at Broad Ripple, some nine miles above the city. The water is carried from this point along the canal, which is 40 feet wide, 5 to 9 feet deep and 9 miles long to the filtration plant where part of the water is diverted into a sedimentation basin of 48,000,000 gallons capacity; the balance being carried to the Washington station and used for power purposes. The sedimentation is by natural means during the greater part of the year; but when the turbidity becomes greater than 30 or 40, lime and iron or other coagulants are used. From this basin the water passes through a slow sand filter consisting of 6 units of eight-tenths of an acre each. It may then pass either into clear water basins of 4,000,000 gallons storage capacity, or into a 52-inch conduit which conducts it to a covered reservoir of 6,000,000 gallons capacity located at the Riverside Pumping Station. In this plant is located a steam turbine which is hereinafter mentioned.

The conduit is then continued to the Washington Station 6,000 feet further south of the Riverside Station. The Washington Station takes suction from a large well supplied by this conduit.

The combined pumpage from the two stations above noted averages about 20,000,000 gallons per day, a maximum of 30,000,000 gallons has been reached, and in case of a large fire a 48,000,000 gallon rate has been noted.

### HYDRAULIC TURBINE UNITS.

The pumping equipment at the Washington Station is driven by hydraulic turbines; the steam engines having been entirely displaced. The accompanying photograph and floor plan show the pumping installation at this station. As will be noted, each four-stage centrifugal pump is connected to two pair of turbines. The pumps are of the inclosed impeller type, with 36-inch wheels; delivering direct into the supply mains through the control valves shown.

The turbine wheels consist of two pairs of 16-inch improved New American turbines, manufactured by the Dayton Globe Iron Works Co., of Dayton, Ohio. They are of the improved inward flow type, set horizontally. Each unit is designed to deliver 350 h.p. at 550 r. p. m.; or 220 h.p. at 450 r. p. m. under a 29 foot working head. They operate on normal domestic pressure at 400 r. p. m. increasing to 500 r. p. m. on fire pressure. The bearings are of the generator type, with large oil chambers and oil rings.

At the power and speed above noted, i. e., with the pumps operating under domestic pressure, the turbines have a rated efficiency of 80 per cent. By reason of some minor changes and capable handling, the present efficiency under domestic pressure is about 82 per cent.

The wheel flumes are 5 feet in diameter by about 6 feet long and consist of heavily ribbed cast iron heads mounted on a cast iron base. The delivery pipe is so designed that a reduction in section supplies an equal volume of water to each of the four turbines. This delivery pipe is shown in the accompanying photograph of the canal dam and tail race. The wheel valves provided are operated by draw shafts in such a manner as to do away with all gearing within the water. The draft tubes are of special design, extending out from beneath the wheels as shown in the

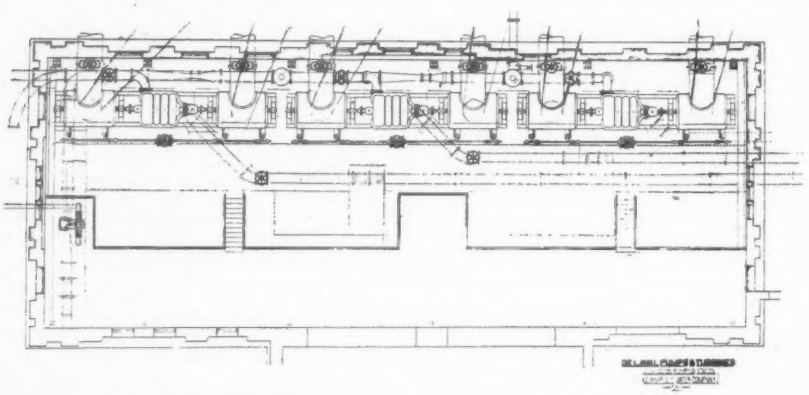
accompanying drawing. They increase in diameter from 36 inches at the wheel to 8 feet at a point of delivery beneath the water surface outside of the building.

The accompanying photograph shows the tail race, the draft tubes discharging beneath the water in the foreground.

The turbines are direct connected by a 2 15-16-inch steel shaft to two 36-inch, 4-stage centrifugal pumps. The impellers are of special design by reason of the pressure conditions; a maximum efficiency being obtained under normal domestic pressure. An increase of speed to about 500 r. p. m. gives a fire pressure of 300 feet.

DeLaval Steam Turbine Co., of Trenton, New Jersey, and installed by Dravo, Doyle Company, of Pittsburg, has recently been installed at the Riverside pumping station. This unit, which is rated at 8,500,000 gallons per day, is operating almost continuously at 10,000,000 gallons, and has at times delievered over 11,500,000 gallons, the exact amount being unknown by reason of the fact that the Venturi meter on the discharge is only calibrated up to 11,500,000 gallons.

The steam turbine is of the De Laval single stage "velocity" type with a 32-inch wheel. A complete expansion of steam takes place in each single nozzle; steam entering the nozzle at



FLOOR PLAN, WASHINGTON STATION, INDIANAPOLIS.

The old pumping plant at the Washington Street Station had a capacity of about 9,000,000 gallons per day. With the turbine centrifugal units, the pumpage is increased to about 15,000,000 gallons per day. The turbines are operated in conjunction with the steam turbine unit installed at the Riverside Station.

A peculiar condition is fulfilled in the hydraulic turbine installation. It was necessary to take water at a head of 30 feet and generate power sufficient to pump water at fire pressure which is approximately 300 feet. This made necessary the combination of two pairs of turbines to each pump. The turbines operate in parallel, developing sufficiently high rotative speed to obtain the required pressure in the pumps which operate in series. In this manner, when delivering at fire pressure, a delivery head of 75 feet to the stage is obtained in the pumps.

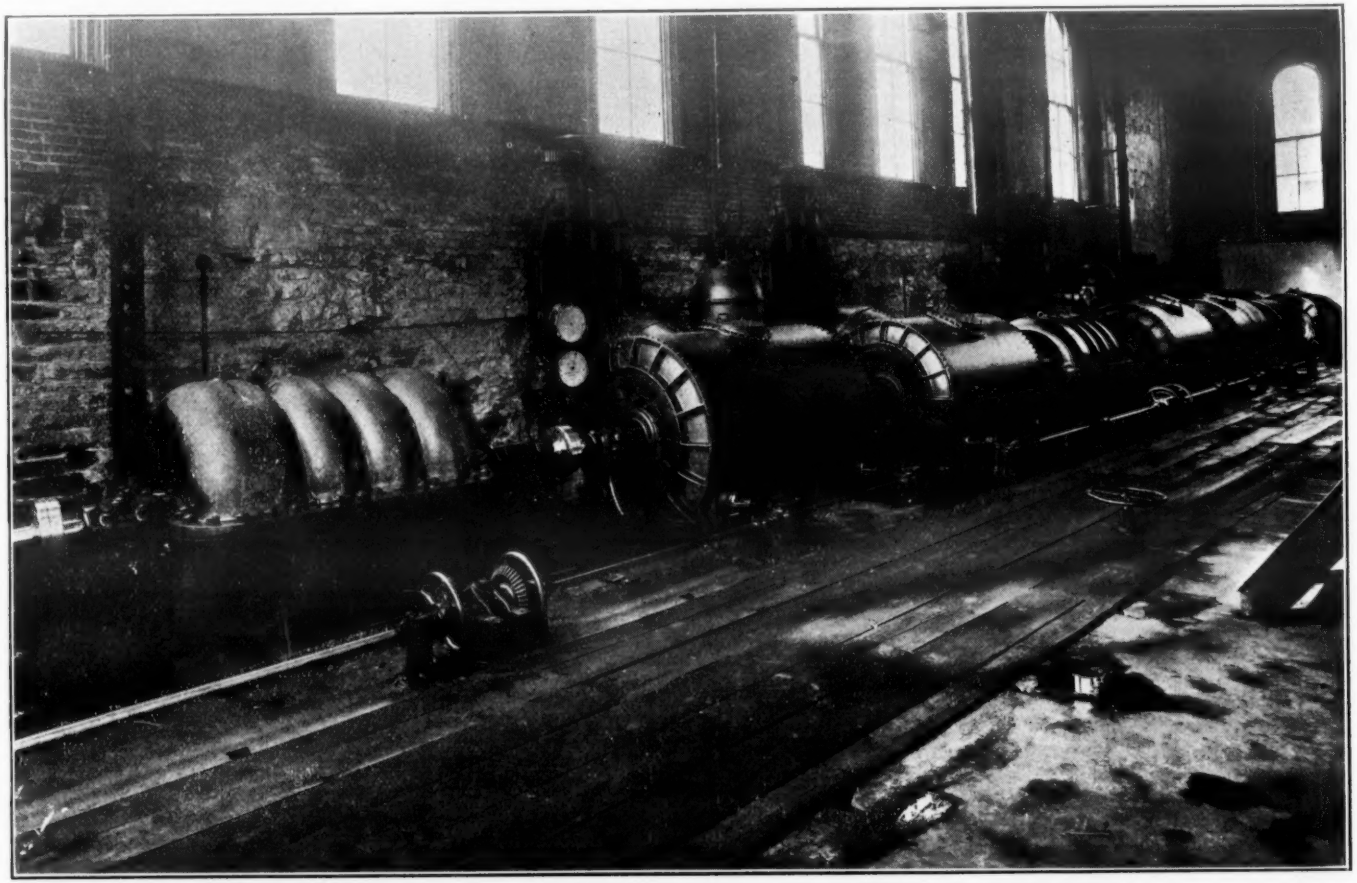
STEAM TURBINE UNIT.

A steam turbine driven centrifugal pumping unit, manufactured by the

full pressure expands to exhaust or condenser pressure, converting all the heat energy available into velocity energy before the steam impinges on the buckets of the wheel.

A series of low pressure nozzles, 26 in number, are distributed around the periphery of the wheel so that a sufficient number of nozzles are provided to suit a wide range of speeds. In addition to these there are 8 high pressure nozzles provided in event that it becomes necessary to use the turbine without the condenser.

The turbine proper consists of a high carbon steel disk fitted at the periphery with a single row of steel blades and enclosed in a steel casing. The disk is secured to a light flexible shaft of small diameter. This flexible shaft allows the wheel to assume its proper center of rotation. It is supported on three self-aligning bearings, the one at the side of the wheel nearest the pump side of the turbine, being entirely free to oscillate; operating only to seal the wheel casing against leakage. The power is transmitted through the



HYDRAULIC TURBINE INSTALLATION, WASHINGTON STATION, INDIANAPOLIS.

shaft to two special gears of improved type, enclosed and running in oil. These gears reduce the speed at a ratio of 10 to 1.

The power of the turbine depends upon the number of nozzles in action, and these can be opened and closed by a hand wheel at each. Each nozzle performs its work as efficiently when operated alone as when operating in conjunction with others. It will deliver 525 h. p. at 9,000 r. p. m. About 14 to 15 pounds of steam per brake horse power is used.

The pump, which is direct connected to the steam turbine, is a De Laval duplex series double suction type. The impellers are of bronze, so designed as to be hydraulically balanced against side thrust on the bearings, which are of the generator type, ring oiled. The suction and discharge are both 16 inches in diameter.

This unit is used for continuous service, delivering from 8,500,000 to 11,500,000 gallons. In case of fire, a few more steam nozzles are opened on the turbine, providing a higher speed with a corresponding increase of quantity from the pump.

The accompanying tables were compiled from data taken under direction of C. H. Hurd, chief engineer, C. R. Waller, of the De Laval Steam Turbine Co., and J. D. Berry, vice president Dravo, Doyle Co., Pittsburg.

TABLE I.

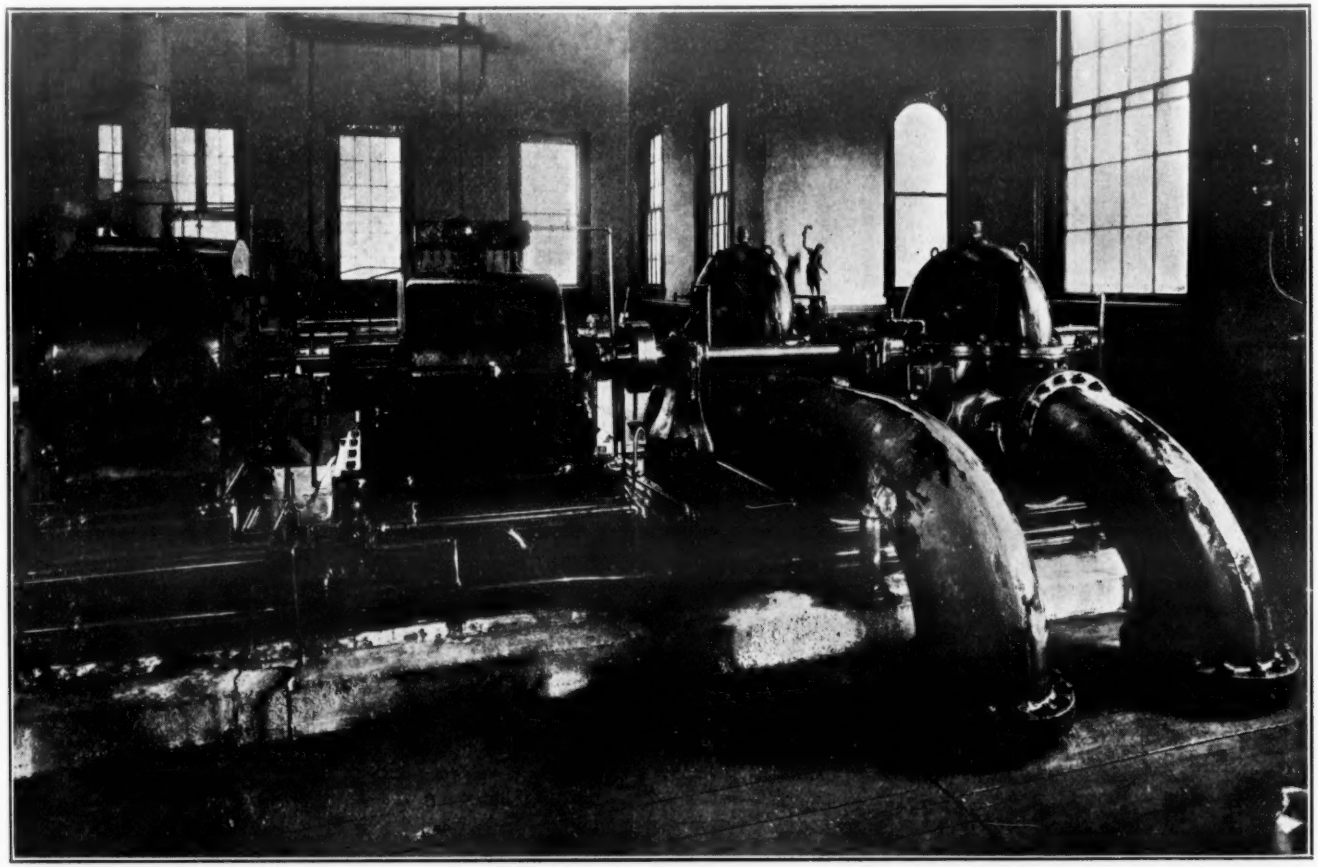
FIRE PRESSURE CONDITIONS.

| | |
|---|---|
| Suction lift in feet | 10.21 |
| Discharge head in feet | 227.23 |
| Correction (difference in elev. of gauges) in feet | 4.16 |
| Total head in feet | 241.70 |

CANAL DAM, TAIL RACE AND DELIVERY PIPE AT WASHINGTON STATION.

| | |
|---|---|
| Nozzles open | 20 |
| Vacuum in turbine case, inches of mercury | 28.40 |
| Discharge per day, gallons, by Venturi meter | 9,477.500 |
| Discharge per hour, gallons. | 394,895.83 |
| Discharge per min., gallons | 6,581.6 |
| Steam pressure at throttle, lbs. | 176.83 |
| R. P. M. | 884.30 |
| Steam consumed per hour, lbs. | 7,853 |

Duty=101.32 million foot lbs. per 1,000 lbs. of steam.



STEAM TURBINE UNIT, RIVERSIDE STATION, INDIANAPOLIS.

TABLE II.

DOMESTIC SERVICE CONDITIONS.

| | |
|---|---|
| Suction head in feet..... | 13.607 |
| Discharge head in feet.... | 142.000 |
| Correction (difference in elev. of gauges) in feet. | 4.160 |
| Total head in feet..... | 159.767 |
| Nozzles open..... | 14 |
| Steam pressure at throttle, lbs..... | 175.17 |
| Vacuum pressure at throttle, lbs..... | 175.17 |
| Vacuum in turbine case, inches of mercury..... | 28.00 |
| Speed R. M. P..... | 754 |
| Discharge per day, gallons, by Venturi meter..... | 9,023,700 |
| Discharge per hour, gal.. | 375,987.5 |
| Discharge per min., gal.. | 6,266.5 |
| Steam per hour, lbs..... | 5,518.33 |

Duty=90.7 million ft. lbs.
per 1,000 lbs. of steam.

The turbine unit has proved exceptionally efficient, having exceeded the guarantee conditions of the contract under which it was purchased to such an extent that a bonus was allowed to the contractors upon its performance. As will be noted from the above tables, the vacuum was held at 28 inches, which was the condition upon which the duty clause of the contract was based and the bonus provided. From later tests at which a higher vacuum was maintained an even greater duty per thousand lbs. of steam was obtained.

The following table gives a summary of all the tests made to date showing the various number of nozzles used, from 8 to 20, the various heads and the duties obtained:

The conditions in Indianapolis are unique for a city of such size, as a fire pressure is furnished direct; the steam fire engines being called in use in only a very few instances. This makes necessary the maintenance of an exceedingly large capacity of reserve pumping units. The present pumping equipment entire comprises in all about 85,000,000 gallons capacity, while, as was noted above, the maximum that has ever been required has been but 48,000,000 gallons. This fact makes the steam turbine practically an ideal unit for use under the conditions. The company has announced its intention of installing more of the steam turbine driven centrifugal pumps as the need for additional units arises or when it becomes necessary to replace the present reciprocating engines.

Mr. Hurd has expressed his entire satisfaction with the unit as fulfilling the purposes for which it is intended. As a reserve unit it costs little to operate, is efficient and requires little attention to maintain or operate, and affords a combination of speeds and capacity at comparatively high efficiency. In addition to this, the centrifugal pump is low in first cost, and where coal is cheap, the steam turbine unit, when everything is considered, is the most economical type. The slight balance in favor of the reciprocating engine as regards higher duty is more than off-set by the conditions above noted where a unit is required for intermittent use.

In addition, there are a number of features in which the steam turbine unit is far superior to the reciprocating engine. There is no expenditure of steam when the engine is inoperative; while in the case of the reciprocating engine, steam must be kept on jackets and coils, and in addition there will be some waste due to unavoidable leakage.

TABLE III.

SUMMARY OF TESTS—DELAVAL TURBINE—RIVERSIDE MARCH, 1911.

| Nozzles open Number. | Total head in feet | Steam pressure in pounds. | Vacuum inches of mercury. | Steam consumed per hour Pounds. | R P. M. | Discharge per day Gallons | Duty million ft. lbs. per 1000 lbs. steam |
|---|---|---|---|---|---|---|---|
| * 8 | 164.35 | 173.75 | 27.97 | 4,028.00 | 679.85 | 5,709,000 | 80.955 |
| 10 | 152.04 | 175.42 | 28.73 | 4,159.00 | 674.00 | 6,933,000 | 88,031 |
| *12 | 157.74 | 176.92 | 28.02 | 4,789.00 | 709.10 | 7,880,000 | 90.150 |
| *14 | 159.77 | 175.17 | 28.00 | 5,518.33 | 754.00 | 9,023,700 | 90.700 |
| 16 | 157.10 | 177.50 | 28.60 | 6,318.00 | 804.00 | 9,876,700 | 85.301 |
| 18 | 157.91 | 179.50 | 28.50 | 7,039.00 | 886.50 | 10,459,800 | 81.520 |
| *20 | 250.11 | 176.98 | 27.98 | 7,742.50 | 886.00 | 8,989,000 | 100.858 |
| 20 | 241.70 | 176.83 | 28.40 | 7,853.00 | 884.30 | 9,477,500 | 101.320 |

In the reciprocating engine the cost of packing and lubrication is very high. The packing for plungers alone, costs several hundred dollars per year, while the valves and other parts form a considerable item. In the steam turbine there is no packing except in the small glands on the shafts, and no valves. The lubrication cost is very low as only the bearings require oil. Then, too, there is no oil in the steam which passes into the condenser and the latter may be used again, without treatment, as feed water.

With the centrifugal pump there are no pulsations which are usual with pumps of the reciprocating type. The quantity of water delivered varies inversely with the pressure, with a constant horse power. It is particularly adapted to fire pressure service as the mere setting of a few nozzles causes the pressure to climb without any surden shock and with no delay in starting if the engine is at rest.

The cost of labor both in maintenance and operation is much less in the case of the turbine driven centrifugal unit. But the most attractive feature is the low first cost, its economy over a wide range of conditions, its reliability, and the small amount of space occupied by this character of installation. The centrifugal unit shown in the photograph pumps 11,500,000 gallons and occupies a space about 17 feet by 6 feet.

It must not be understood that Mr. Hurd recommends the steam turbine centrifugal unit for all purposes, but rather he recognizes its superiority as a reserve unit under most conditions.

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# Hydro-Electric Practice

By H. A. von Schon, M. Am. Soc. C. E., Consulting Engineer, Detroit, Mich.

## Operation and Maintenance of Dam and Reservoir

IN my former articles I have discussed methods by which the commercial value of a water power project may be safely found, and which should be adopted in the designing and constructing of the plant in order to secure the most resourceful development, and in these, the closing articles of this series, I present the maintenance and operation of such a plant.

In compiling the estimate of the operating and maintenance cost of a plant, they are generally taken at 20 per cent of the cost of the works and 5 per cent of that of the equipment, and while this holds true of the general average, being based upon statistics of a large number of plants in commission, the rate may be considerably lowered, especially as pertaining to the works, and on the other side it may be greater. Broadly speaking, any maintenance cost of such works is a penalty paid for faulty design or construction as, barring some accidents which cannot be economically guarded against and which may or may not occur in a life time, the works may readily be so conditioned as to be absolutely permanent and requiring no repairs. In this respect hydro-electric plants differ from those of other industrial enterprises; they can and should serve the purpose of permanently re-arranging the original natural conditions and fixing them in the desired new order without violation of the laws of nature, but by adapting them to these in every essential detail. When planned and executed in this manner, the spillway, dam, canal and power-house become permanent features and fixed for ages.

The works consist of the spillway, abutments and reservoir embankments or bulkheads which complete the dam system; canal, flume or pipe line; headgates, intake, forebay, power-house and tailrace with the possible addition of storage reservoirs.

The spillway serves the purpose of partially ponding the flow, maintaining the desired upper level, and passing all water in excess of that to be utilized for power development. It may be constructed of timber, concrete, masonry or concrete-steel. The defects of the spillway may be underwashing, settlement, temperature cracks and injuries to the crown, toe and apron.

Underwashing is the passing of water beneath the sub-structure, and may occur with any of the different spillway types. When in rock location, the formation being stratified, water may find a passage between layers of rocks; the origin or upper end of it

may be near or at a considerable distance up-stream of the spillway. The consequences may never imperil the safety of the structure, but the volume thus passing beneath is likely to increase and prove a considerable loss from the available low flow. The upper pool should be lowered by opening the underflow sluices, and the location of the underwash determined; when the upper pool is down to a depth of two or three feet, the entrance to the passage way will be readily detected by the disturbed surface in its vicinity, and investigations as to the extent of the fissure can then be made. If the surface rock near the opening is solid it may be closed by concrete placed in bags. The mixture should be rich, the gravel aggregate not larger than will pass a half inch ring. The bags are of jute, filled about half and securely tied. When the surface rock is shaly, the loose pieces must be removed. If the origin of this passage cannot be readily found, the water at a distance above the spillway may be discolored by some aniline, dye-stuff or blueing, while the appearance of this color is watched for below the spillway; if it is not discovered within fifty feet down-stream of the spillway, it is likely that the passage is at considerable depth below the sub-structure, and in that event it will be a hopeless and exceedingly expensive task to remedy the defect. If, however, the discolored water appears close below the spillway, it indicates that the water passes below the top layer of the stratified rock and the passage may then be closed by cutting a channel some two feet wide out of the rock about ten feet up-stream of the spillway abreast of the point where the discolored water appears below the structure, and through the first and into the second rock stratum. This channel cutting should be preceded, however, by making test drills at various points up-stream of the spillway until the water passage-way is struck. The channel, when properly located, is filled with concrete placed in bags, creating a concrete curtain or cut-off.

Underwashing of spillways in rock location is a rare occurrence. The author calls to mind such a case at a Government dam on a Southern river. The formation is of stratified lime rock and ever since the construction of the lock and dam such an underwash has there existed, and has at this time (the author examined it recently) assumed considerable proportions, passing approximately fifteen cubic second-feet when the upper pool stands at the level of the spillway crest. This passage crosses under the spillway foundation and one of the lock walls, but the only serious consequence to the plant is evidenced by the difficulty of opening the upper lock gates, which can be accomplished only by means of block and tackle.

The failure of the Austin, Texas, dam was in part caused by underwash. Its location was in stratified limerock, which, at the eastern end where the first break occurred, was shaly and faulty, the dam being destroyed during a high flood by sliding off its base in sections.

Much more frequent and more serious of consequences is the underwashing of spillways in alluvial locations. In fact, it may be stated that they are in a large number of cases the original causes of the failure of the spillway. Most alluvial stream beds contain strata of sand, gravel and boulder formations which are porous in their very nature. If overlaid by clay or hardpan of a depth equal to about one-fourth of the maximum height of water retained by the spillway, there is little likelihood of water breaking through the impermeable upper material into the porous strata. But frequently the latter pass through the clay or hardpan with an upward continuation, even at a considerable distance up-stream of the spillway, and under such conditions they readily form a passage for the water. If a proper curtain has been placed up-stream of the spillway, cutting off such a porous stratum, there is little likelihood of an underwash occurring, and if it does appear it is evidence that the curtain has opened or was not driven deep enough and the fault must be corrected by just such a device.

The determination of the locus of the underwash will be made without much difficulty, as it requires but a brief space of time for such an underwash to excavate a considerable space. The under pool must be lowered promptly and the washout coffered by a sheet pile curtain of timber or steel piles driven on the upstream side of the original curtain; it should be extended from 20 to 30 feet on both ends and the space between the two curtains filled with concrete in bags. When considerable of the material underlying the spillway base has been washed out, the condition may or may not endanger the stability of the structure. As a rule the void should be refilled by excluding the water from the

down-stream side by coffering and, if the washed area cannot be pumped out, by placing concrete in bags as above detailed. All the conditions growing out of underwashing point forcibly to the great advantage of the hollow concrete-steel spillway. Such a structure will not be seriously injured by a washout, while the latter can readily be refilled by penetrating the spillway base and passing suitable material through it into the space beneath by a variety of methods, all of them possessing the pronounced advantage of showing with considerable certainty what is being accomplished in the way of remedies. A timber spillway is not so likely to underwash as the masonry or concrete type, as the interior filling of rock will fill any opening caused by leaks.

Settlement of the spillway would be due to faulty foundation design or construction and be followed by cracks and leaks. If the defect is at all serious, the foundation, at the faulty point, should be extended up or down stream, or in both directions, and these extensions rigidly connected to the original foundation or sub-structure. The cracks can readily be refilled.

Temperature cracks may be looked for in any masonry spillway during the first winter. No remedy can be effected until the following spring, when cement milk (fluid cement) may be forced into the cracks, or into holes drilled into the masonry at the top of the crack locations, by aid of a hand pump.

The crown of the spillway may be injured by shocks from logs or ice. If floatage is plentiful, a timber whaling guard should be secured to the up-stream edge of the crown. Ice pressure may be exerted against the spillway crown in northern latitudes from a thick ice covering on the upper pool to a dangerous extent. In such locations ice fenders should be provided and an open channel two feet wide should be maintained a few feet above the spillway.

The apron down stream of the spillway may be injured and even destroyed by excessive overfall or the shocks from passing logs. The author recalls a spillway on a Government dam of a Southern river where the down-stream curve of the spillway was so unfortunately designed that, with an overflow depth of from 2 to 4 feet, the passing logs would be raised up out of the water into a nearly vertical position and strike the apron end on, like a pile acting under the force of a dropping hammer. The apron was entirely destroyed during the first high overflow. When the apron is too short, (it should always be of a width equal to the height of a spillway) it may readily be undermined and, if of masonry, will then settle and break up.

At the Holyoke, Mass., timber dam, which has been displaced by a masonry structure during the last ten years, the approach was entirely washed out, and in addition a trench exceeding 30 feet in depth was created by the overfall. This apron should be designed with the same care as the spillway foundation itself, in fact it is a part of it. Spillways in alluvial locations have been known to be deflected down stream bodily, though they may be safe against sliding. The cause is the moving of the entire underlying mass in which the bearing piles stand. It is therefore recommendable, in soft locations, to drive every other longitudinal pile row with the greatest practicable down-stream batter, by which any such tendency to deflect the foundation would meet the additional resistance of the inclined piles and thus be generally prevented.

Spillway operations pertain entirely to the control of the flow. No matter how small the fluctuations may be, the spillway should be provided with some sluice capacity, if for no other reason than the required facility to lower the upper pool level for the purpose of removing silt accumulations and making necessary repairs. Sluice gates should be operated at regular intervals, at least once each week, in order to be assured that they are in serviceable working conditions and free from choking sediment and floatage. The operating gear should be kept free of rust and lubricated. The gate posts, and in fact all of the timber framing above water, should be painted annually. Pike poles and trash rakes should always be kept on hand to remove any logs or roots which may lodge against the gate or its frame.

Flashboards form an important device. The particular local conditions and the frequency of utilizing them will soon point to the most expeditious and convenient operating routine.. The most important feature is that they can be readily removed at the approach of a rise in the stream to avoid their loss and prevent undue pressure against the spillway. On account of the ice they cannot be successfully operated during the winter season in Northern latitudes. Some automatic types have been developed, but the au-

thor knows of none which are economically practical for the purpose.

Log chutes deserve the same operating care as sluices and their gates. A boom must be maintained up stream to their entrance, and when logs are passed they should not be permitted to crowd the chute's capacity, but must be steered to take the chute square and straight.

Fish ladders require no special operating care, but must be examined in the spring of the year, as they may have been injured during the winter by the ice.

Abutments, if properly designed and constructed, are not likely to be injured, excepting by underwashing, settlement or temperature cracks; the remedies described for the spillway apply as well to the abutments. A very frequent defect, however, occurs on the land side of the abutment when the connection between it and reservoir embankments is insufficient. A washout is very likely to take place there. Nearly every high flood rise on the Ohio and its tributaries witnesses its repetitions. The author visited two Government dams and locks which were isolated midstream, the river having broken its way past the abutments. The location was in clay and gravel. The structures had just been completed and the first flood rise found the weak points. In both cases the natural river channel had been greatly contracted by a short spillway in order to find location for the lock structure, and the corresponding rise of the flood waters had broken through. The works were not otherwise seriously injured. Both were re-designed and given greater flood discharge capacities and concrete core walls were carried further into the banks. The necessity of providing the longest practical spillway, not less than the natural channel width, has been fully dwelt upon in the treatment of designs, also connecting the abutments by a substantial core wall leading into the natural or artificial banks which complete the dam structure.

Reservoir embankment or bulkheads complete, with the spillway, the impounding of the upper pool. When of earth fill the probable defects occurring in them are underwash, subsidence and erosion.

Underwash of reservoir banks is similar to that described in connection with spillways; their causes, in addition to those already cited, are frequently traceable to roots of trees formerly standing on the embankment site. The water passes along these and thus may break through under the structure. If the site is properly prepared, there is no likelihood of any underwash. The remedies of such defects are like those given for spillways.

Subsidences of the banks are the sliding of considerable portions. In the up-stream bank these may be caused when the upper pool is lowered too quickly, so that the water in the bank cannot leave the material as rapidly as the surface falls, and then follows under the pressure of its head above the pool level and carries with it the bank material. The lowering of the upper pool should be restricted to two feet per hour, when no considerable accumulations of water will be retained by the bank. Subsidences of the up-stream bank occurring with filled upper pool are due to defective material in the bank or its insufficient compactness; or they may be caused by portions of the pavement becoming detached and, while sliding down, gradually, taking bank material along with them. If the pavement is laid on edge and the vertical interstices are staggered and well filled with spalls, this is not likely to happen. When the level in the upper pool fluctuates frequently and the water thus rises and falls constantly along the paved slope, the latter had best be of concrete anchored to the material. This class of paving is also recommendable when much wave action is likely to prevail in the upper pool on account of the prevalence of down-stream winds. Subsidences in the down-stream bank are also caused by the rain run-off finding an entrance into the material in considerable quantities. This may be due to an excess of clay in the mass which, when dry, cracks and thus opens the way for rain to enter, which will loosen portions of the bank and they will become detached from the mass and slide down. With proper material and a thick stand of slope grass this is not likely to be the case.

Erosion of a reservoir bank is the cutting of its surfaces by concentrated rain run-off. Its origin is at the top, where the crest and slope lines meet, and it is enhanced by slopes of too great a length. This fault occurs especially on the down-stream slope, and is more frequent when the top is used as a highway, in which event the wagon ruts and other road defects become the source of the trouble. In some localities burrowing animals cause considerable damage to earth embankments, generally just above the water line. None of these will seriously en-

danger a reservoir embankment which has been provided with a proper core wall. Frequent inspection of the embankment is the main operating function, and repair of the slope pavement and of the crest dressing, and maintaining a good turf on the down-stream slope, are the principal matters requiring attention.

When the reservoir structures are concrete-steel bulkheads, the defects and their remedies given for spillways apply. However, as no water is to pass over them, they may be under constant inspection whereby repairs can be properly made, though if properly planned and constructed they will need none.

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# Rate Making*

By Frank C. Jordan, Secretary of Water Company, Indianapolis, Ind.

THE most important consideration for the city is the provision of a dependable supply of water, which will be furnished to the citizens without discrimination, after which a rate must be agreed upon which will provide a sufficient fund to take care of the following items:

1. Necessary operating expenses;
2. Proper maintenance of the property;
3. Depreciation charges;
4. Interest charges on the investment in the plant;
5. In the case of the privately-owned plant, a reasonable profit sufficient to encourage capital to incur the risks of this class of enterprise.

The first item, viz.: Necessary operating expenses, will include those items necessary to the proper operation of the company, bearing in mind at all times the desirability of furnishing a supply of pure water which has undergone a purification process if such treatment is necessary, and which shall be furnished at a uniform pressure sufficient to provide a satisfactory service throughout the entire city. The courts and Public Utility Commissions are giving due credit to good management and in the future more credit will doubtless be given in a financial way to that management which, with careful attention to details and the exercise of that which we call "far-sightedness," is able to provide a good supply at a low cost of operation.

The importance of the second item, viz.: Proper maintenance of the property, is so well understood that there is no need of any discussion of this item.

The third item, viz.: Depreciation charges, is an item with which, unfortunately, a great many of the plants are not familiar. Recent court decisions have called our attention in very plain terms to the necessity on the part of the Water Company or Department of setting aside in a separate fund an amount which will, at the termination of the life of a company, leave intact the value of the physical property of the company, and the court has held, in no uncertain terms, that the company or department is in error which fails to lay aside from its annual receipts proper depreciation charges.

The fourth item, viz.: Interest charges on the investment in the plant, is one which must be taken into account in an accounting system, and yet we will frequently hear certain water works managers give statements covering the cost of furnishing water and, on careful inquiry, will find that no account whatever is taken of the interest on the investment. This obviously is misleading and the interest on this investment is as surely a charge against the consumer as the ordinary operating expenses such as coal, oil, etc.

The last item, viz.: A reasonable profit to the investor, is one about which there should be no question, although there unfortunately has been an apparent desire on the part of some authorities to make such rates as would prohibit the showing of a fair return to the investor. It has been held by the Supreme Court that the investor is entitled to a fair return on the value of his investment, but it has also been held that the investor is not entitled to an income on expenses incurred on account of gross error or lack of reasonable care. It has been held that a plant should be appraised as a "going concern" with a proper credit for the

*From a paper before the Illinois Sanitary and Water Supply Association.

reproductive value plus the added value of the business on the lines, which has been procured at a considerable loss to the investor.

Courts and Public Utility Commissions have disagreed on the percentage of this return on the investment, the rates varying from 7 to 10 per cent. per year on the total value, and it would seem that the latter figure is not far from a fair rate, when we take into consideration the risks connected with this class of enterprise. With a proper appraisement and with reliable data covering the cost of operation and other expenses, the annual revenue necessary to take care of the plant can be ascertained, after which comes the question of the proper distribution or assessment of rates to provide this amount.

In connection with this subject it has been shown that a thorough accounting basis is indispensable in the proper solution of the question of rate making, and it is unfortunately true that scarcely 50 per cent. of our companies, whether public or private, can tell within a reasonable degree of accuracy what it is costing them to furnish a million gallons of water to the private consumers, and in many cases it is even impossible for them under their present accounting system to arrive at a figure giving the actual cost of the production of a million gallons of water. It is agreed by all that the company, whether private or municipal, must furnish water to the citzens without discrimination, but there is room for argument as to what constitutes discrimination. Every department manager will admit that there are certain sections of his city which have not and will not for years pay a sufficient revenue to the water department to take care of the proper charges on the investment, and yet it is so desirable to have these sections taken care of as regards fire protection and sanitary measures that it becomes advisable to install the lines, even though their installation imposes a burden on the better districts of the city, and the rates must be so arranged that the consumer with a large property will pay a sufficient amount to insure profit large enough to offset the loss on the properties in the poorer districts.

It is admitted that the water mains add to the abutting property a certain value and it has repeatedly been shown that the principal asset of a company is in its readiness to serve. In making a rate a certain charge must be made for this readiness to serve, whether the charge covers the readiness to serve in the case of fire protection or in the case of standing ready to serve at a faucet or connection in a private residence. As is often the case, the water department may not be called upon for service in the case of fire protection lines and yet the service rendered is just as valuable for the reason that the consumer has received his full benefit in the way of protection, thus reducing his insurance premium and reducing the liability of the suspension of his business on account of fire damage. In the case of the private consumer, the desirability of having a good supply always at hand is apparent, and is worth a certain fixed amount.

In preparing estimates on which the water rates are based, consideration must be given not only to the amount of water to be furnished to each consumer, but careful consideration must be given to the amount of water which will undoubtedly be lost on account of leaky services, broken lines, etc., the cost of which is just as much to the department per million gallons as that water which is actually sold. It has been shown that this loss varies from 15 to 25 gallons per capita per day in the New England towns, and it is a well-known fact that these towns are managing their plants in a most careful and conservative manner.

The rate as fixed for water should not contemplate the furnishing of any free water. It is recognized that the term free water is a misnomer, and is an impossibility with the exception of that water which comes from above. The city will always be the largest consumer of the water plant, and a proper rental for fire hydrants as well as a proper charge for all water used for purposes other than for the extinguishment of fires, should be paid by the city and each department should be made to stand for its proper portion of this charge.

It has been estimated that the cost of fire protection is approximately 45 per cent. of the interest and fixed charges due to construction and from 18 to 22 per cent. of the cost of operation. It is doubtful whether the average city would pay to the water company or department its proper share, figured on the above basis, for the reason that in most cases the hydrant rental would apparently be a prohibitive amount, and it, therefore, devolves on the consumer to pay a certain percentage of this cost in his rate.

The amount received from the city

should be deducted from the amount ascertained to be necessary to carry on the operation of a company, and the balance will of necessity be provided from receipts from private consumers. In making the rates it must be borne in mind that the consumer is buying more than water, in that he is also purchasing a certain valuable asset, i. e., a ready to serve condition, and it must also be borne in mind that a charge covering the bare cost of the water will not bring to the Department sufficient funds to carry on its business.

The New England Water Works Association has suggested that in arranging meter rates it should be borne in mind that these rates should insure a sufficient revenue to meet the financial and operative demands of the company; that they should be flexible so that they may easily be changed in case of a deficiency or a surplus of income; that the method should allow the use of meters to the small consumer as well as to the large, and that the rates should secure from the large properties a sufficient amount to meet the proportional fixed charges of the plant even if little water should be used.

It is hardly advisable to figure on a rate which may require an increase in a certain number of years, for the reason that the communities, as a general proposition, are calling for a reduction in rates rather than an increase, and yet it must be borne in mind that the cost of furnishing a safe supply of water is increasing year by year and the rates must inevitably follow the increase in the cost of production.

Various methods of rate assessment have been adopted by Water Companies throughout the country, among them being the frontage assessment plan, the valuation assessment equal to a certain percentage of the flat rate. In some of the municipal plants it has been found that the assessing of a certain percentage on the valuation of the property has worked very satisfactorily; this assessment amounting to from $10 to $15 on a property assessed at $3,000, is called a ready to serve charge and covers a small amount of water sufficient for domestic purposes. Under this plan every citizen of the town became a consumer and the larger property owner pays his proper proportion of the cost of running the company. It is manifestly unfair for certain properties of the city to share in the benefits naturally accruing to the property by reason of the water mains and yet have the property fail to pay its proper share of the cost of the operation of the company.

It has been shown that in the development of a city it becomes necessary to install water mains in certain districts in which the growth of revenue will be exceedingly slow and it will be a matter of interest to the average department to prepare data showing the growth of income in the various districts. It will be a surprise to the average Superintendent to find that, as a general proposition, the average line does not get on a paying basis until approximately 20 years after its installation. As stated before, it becomes important that the rates in the better sections should be sufficient to take care of these outlying districts for the reason that these districts, without water, would become a menace to the health of the community.

For a number of years the flat rate or schedule rate was thought to be satisfactory in its operation, but of recent years there has been a decided tendency toward the metering of water, and some plants have found to their sorrow that the one-rate plan for meters with no ready to serve charge, does not provide sufficient revenue to cover the expenses of the company. The proposal on the part of the company to furnish water to all persons at one rate appears beautiful in theory, but in its workings it is disastrous to the finances of the company. From time to time the advocates of the meter system fall into errors which, in their operation, become serious questions to the company. In an article read before one of our large associations on the subject of the meter system will be found the following:

"One of the most important features of a meter system that appeals to the consumer is the fact that with a meter on his service he is very independent; he can do as he pleases with the water after it has passed through his meter; he can add many spigots without asking permission of any one; he can use a hose to his heart's content, the city's authority ending at the meter."

That company which maintains no control whatever over the water after it passes the meter will, in the course of time, find itself face to face with some unpleasant problems. Many water departments at the present time find it necessary to limit the sprinkling of lawns to certain hours, and it has been found necessary in some departments to make other regulations

regarding the use of water, and the loss of all control over the consumer after he purchases his water at the meter would place the company in an unfortunate position. The very basis of the ready to serve charge depends on a knowledge of the value to the consumer of its readiness to serve, and this of course depends on a knowledge of the number and kind of fixtures which may be served.

In a recent tabulation prepared by the writer, it was shown that the maximum meter rate, covering the smaller consumption, varied from 60 cents per thousand gallons to as low as 5 cents per thousand gallons. It would seem that there should not be this degree of difference and yet when all conditions are considered, it may be that the rate of 60 cents was in fact no higher in the city charging this rate than the 5 cent rate in the other city.

It has been found in a number of cities that the flat rate levied on a reasonable basis and commensurate with the service furnished was satisfactory to a large extent and generally speaking the people have apparently come to the conclusion that a rate of from $15 to $20 covering the cost of a full supply of water for a house of six rooms with all modern conveniences, including sprinkling service, is not far from a fair figure, the difference in the rates of course depending entirely on the conditions existing in the city.

In the establishment of rates the unfortunate mistake is often made of making a rate which is about the average charged in other cities, without taking into consideration the conditions existing in the city under consideration. This is obviously unfair and that committee, upon whom rests the responsibility of deciding on what constitutes a fair rate for the water of a city, should give careful consideration to the conditions existing in their city, and if comparisons are necessary these comparisons should only be made with other cities furnishing a like supply of water under like conditions. As has well been stated on a number of occasions, the public has a right to know the details of the operation of a plant and full publicity of all matters pertaining to the supply of water is absolutely essential, and the writer shares the opinion of the best engineers that the average citizen, if given a clear understanding of the cost of the supply of water, will agree to a rate which is fair and is commensurate with the service furnished by the department.

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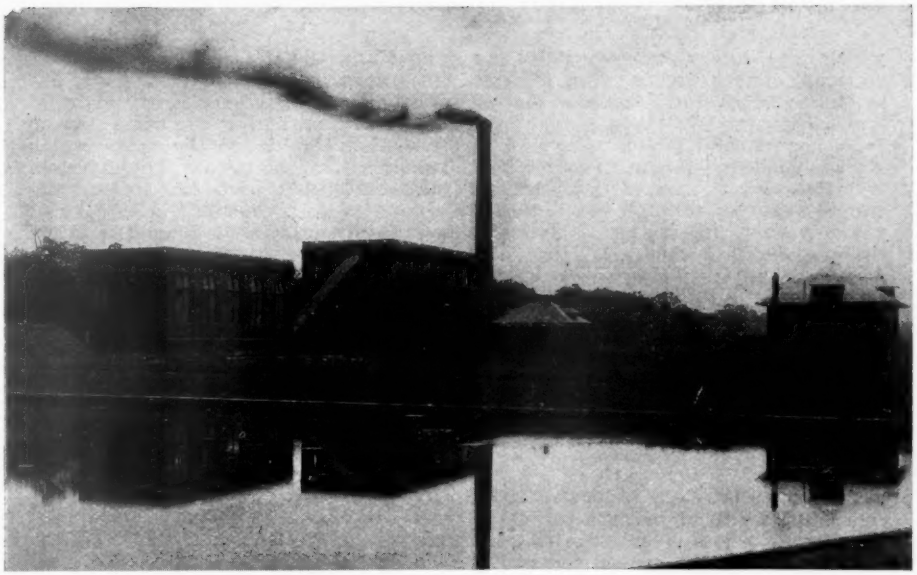
## The Municipal Garbage Reduction Plant at Columbus, Ohio

OVER seven months have elapsed since the city of Columbus, O., started in operation the first municipal garbage reduction plant, designed and constructed by a municipality for the disposal of the garbage and the utilization of the by-products for maintenance. The majority of larger cities in the United States have their garbage disposed of by the reduction process under contract by private companies.

From a commercial standpoint, the reduction of garbage has in most cases proved successful, although failures have occurred in this as well as in other methods of disposal, due to faulty design and lack of proper attention and management. From a sanitary standpoint the reduction of garbage has been looked upon as being very undesirable, due largely to the manner in which the plants have been constructed and operated. This will continue to be the case as long as cities contract for the disposal for a short term of years. The contractor usually cannot afford to install an expensive plant or pay much attention to the design from a sanitary standpoint. Under contract the disposal of garbage is considered chiefly from a commercial standpoint, which consists in obtaining the largest remuneration possible at the least cost.

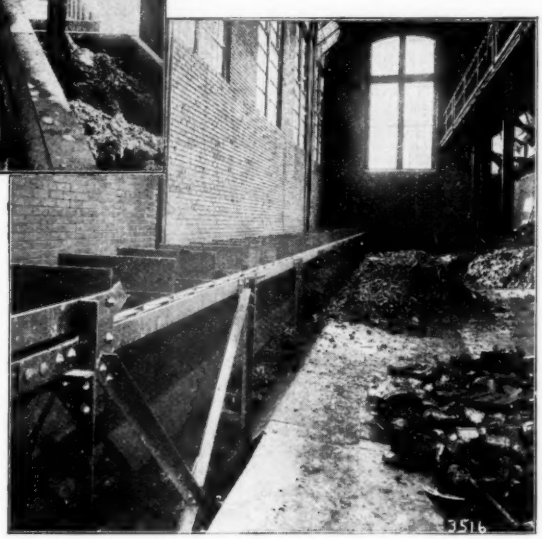
In designing the Columbus plant, the first object was to make it as sanitary and free from undesirable features as possible, and at the same time make the appearance of the buildings and general design agree favorably with other municipal improvements. The plant was designed with a capacity for disposing of 80 tons of garbage in 12 hours, or a total of 160 tons per day with the plant operating continuously. The total capacity of the plant is sufficient to take care of the future growth of the city of Columbus for the next twenty years.

The garbage is collected in wagons



I. COLUMBUS GARBAGE REDUCTION PLANT.
Settling Basin of Sewage Works in Foreground.

II. DUMPING THE GARBAGE AT THE LOADING STATION




III. INTERIOR OF GREEN GARBAGE PLANT, WHERE THE GARBAGE IS SORTED AND SHOVELED INTO CONVEYOR.

which have water-tight steel bodies and sectional canvas covers. The garbage is hauled to a central loading station located on the Hocking Valley Railroad, near Mound street. The loading station consists of a building 40 feet wide by 90 feet long, with a railway track extending through the building.

Fig. 2 shows the method of dumping the wagons into the car; they are drawn up an incline driveway to the second floor of the loading station, and by means of a power hoist the front end of the wagon is elevated, discharging the garbage out of the rear end into the garbage cars below. The cars are constructed with semi-circular bodies especially for handling garbage. These cars have a capacity of 1,400 cubic feet, or 40 tons each.

The reduction plant is located about four miles south of the city of Columbus, on the Scioto river. The railroad tracks at the plant are on top of the levee which surrounds the building site and about 10 feet above the ground floor of the buildings.

Fig. 1 shows an outside view of the plant. The garbage, when delivered, is weighed on railway track scales, and then run into the green garbage building on a siding which extends through it.

Fig. 3 shows an interior view of this building with the garbage dumped and the method of sorting. The free water is drained off through a gutter extending the full length of the building; the swill water from the gutter is drained into a catchbasin, from which it is discharged into the grease-separating tanks, after which it is evaporated.

The garbage is sorted and shoveled into a scraper conveyor shown alongside and extending the full length of the building. This is a Jeffrey type scraper conveyor and extends to the main building, carrying the garbage along the incline truss to the top of the main building, and then along the bottom chord of the roof trusses and over the tops of the digesters. Connecting the conveyor with the digesters are swivel spouts which discharge the garbage directly into the digesters.

Fig. 5 shows a photograph of the digester floor and the method of delivering the garbage from the conveyor to any one of the eight digesters through the feeding spout.

Note the longitudinal section, Fig. 4, showing the arrangement of the digesters, they being eight in number, each 7 feet in diameter by 14 feet long, each having a capacity of 10 to 12 tons of garbage; the inside is lined with cement and tile, 1½ inches thick, so as to protect the digester from wear, due to the agitating of the gritty material when boiling, and at the same time to resist the action of the acids which would attack the metal. The digesters are arranged in nests of four, and are connected to a common receiving hopper, which is directly connected to the roller press. The four digesters, one receiving hopper and a roller press are called one unit.

The time required for cooking varies with the kind of the garbage, but averages about six hours, with steam at 60 to 70 pounds pressure as it enters the digester.

The presses, which are connected to the receiving hopper, are of the continuous roller type, and were designed by Chas. Edgerton especially for handling garbage. They are directly connected to the bottom of the receiving hopper, so that the material from the digesters passes through the press before being exposed. The press is provided with an upper and lower conveying apron. The upper apron is made up of ½-inch steel slats riveted to a heavy forged steel chain. The upper apron acts as the bottom of the receiving hopper, and when the press is running carries the material through the feeding rolls and discharges it onto the lower apron.

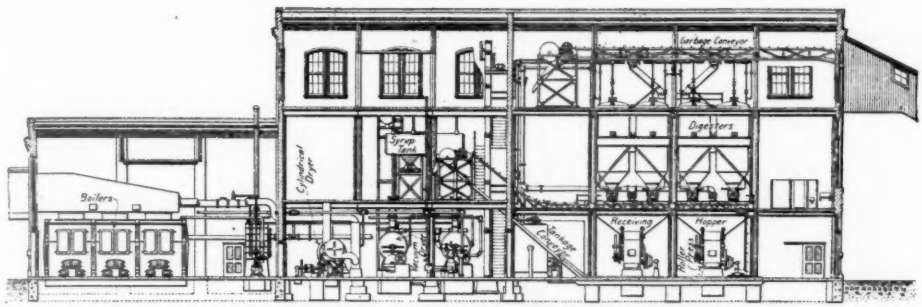
The lower apron is composed of perforated slats ⅜ inch in thickness, and passes through between six cast iron rolls, arranged in pairs.

Fig. 6 shows the presses on first floor. The pressed material is discharged at the front of the press into a Jeffrey scraper conveyor, which carries the material to the second floor of the drying department—see Figs. 6 and 7.

The water and grease flow from the presses to catchbasins in the grease separating room. The grease is drawn off and pumped into storage tanks, ready for shipment.

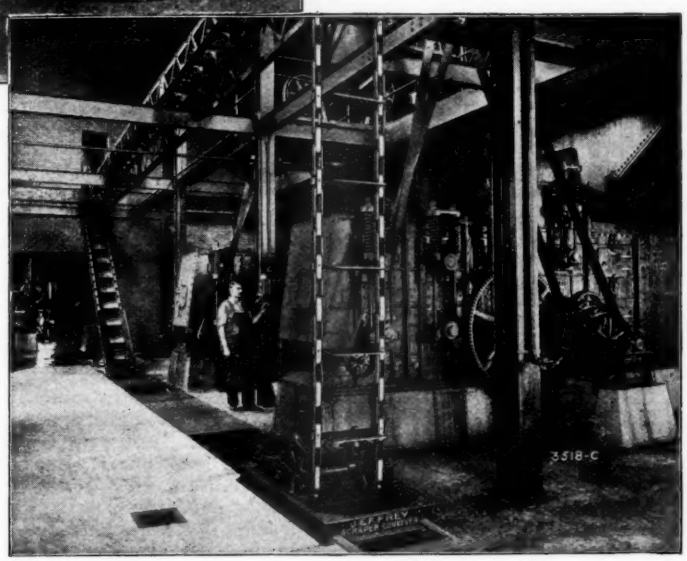
The liquor coming from the presses carries more or less solids in suspension. These solids are known as muck and silt. The muck settles to the bottom of the grease separating tanks and the silt rises to the top of the water.

The tank water, after the grease has been separated, is drawn off to a large storage tank outside of the building. The tank water contains 5 to 7 per cent. of solids in solution; it is evaporated in a triple-effect evaporator. The evaporator is made up of thin rounded-body cast iron pans built especially for the conditions to be met in handling garbage tank water. This triple effect




Longitudinal Section through the Columbus Garbage Reduction Works.

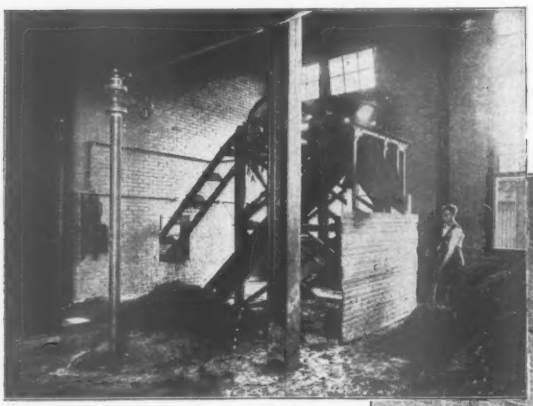
V. UPPER FLOOR, SHOWING JEFFREY SCRAPER CONVEYOR DISCHARGING GARBAGE TO DIGESTERS.




VI. FIRST FLOOR. SHOWING PRESSES DELIVERING DRY GARBAGE TO THE SCRAPER CONVEYOR.

evaporating process is entirely new in the disposal of garbage, although used extensively on the tank water at the large packing houses. The concentrated syrup in the evaporator is drawn off by a Magma pump and discharged into a storage tank on the second floor.

The muck and silt from the grease-separating tanks are placed in a screw press, from which the liquor flows to the catchbasins and the solids pass along in the Jeffrey scraper conveyor to the dryer room—see Figs. 6 and 7.



VII. SCRAPER CONVEYOR DISCHARGING DRY GARBAGE.

VIII. STORAGE FLOOR. BUCKET ELEVATOR DELIVERING TANKAGE USED FOR FERTILIZER.

The solids are then fed to a revolving cylindrical dryer. This dryer is constructed with a steam jacket and radiator coils, which provide heat for the drying process. The material is fed into the dryer continuously and discharged by means of two short spiral conveyors placed at the opposite end.

The dry material issuing from the revolving dryer is then passed through the revolving screen; the screened tankage is then placed in the vacuum or mixing dryers and the concentrated syrup from the evaporator is added. The dry fibrous material acts as a filler and enables the moisture in the syrup to be driven off. The addition of the syrup to the fibrous tankage produces a higher grade of tankage from a mechanical and fertilizing standpoint.

The dryers are 15 feet long and 60 inches in diameter. Through the center of each dryer is a shaft, to which paddles are attached for agitating and mixing the material. When dry, the material is discharged from the dryer into another Jeffrey spiral conveyor connected to a Jeffrey bucket elevator, which discharges the tankage onto the third floor, where it is stored until shipment.

Fig. 8 shows the shipping floor.

This tankage contains a higher percentage of ammonia, due to the addition of the concentrated water issuing from the evaporators. Its appearance is granular and black. Each load of tankage is analyzed, the valuation varying from $10 to $10.50 per ton, according to the amount of ammonia.

The buildings are constructed fireproof throughout, having concrete foundations, steel frame and roof trusses, reinforced concrete floors, brick walls and a hollow terra cotta roof tile, cov-

ered with a built-up four-ply composition felt and asphalt roofing. The exterior and interior walls of the building are laid up with a high-grade, impervious, wire-cut face brick. The construction of all parts, so far as possible, was made to agree with the best modern practice employed in building construction.

The approximate cost of the plant was $180,000, divided up as follows: Grading and levee, $11,000; buildings, $76,000; garbage machinery, $60,000; power and conveying machinery, $30,000; railway tracks, $3,000.

After seven months of operation, the plant has more than met the expectations, as the returns from the sale of by-products have more than paid for the cost of disposal.

The Kutztown Foundry Machine Company supplied the grease-separating machine, digesters and presses. The Zaremba Company installed the evaporator. The entire elevating and conveying machinery, beginning with the handling of the green garbage until the by-products are stored for shipment, was designed and erected by the Jeffrey Manufacturing Company, of Columbus, O.

This plant was designed and constructed by I. S. Osborn, who has made a specialty of the disposal of garbage and municipal wastes and has supplied the information for this article.

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## Legislation on Stream Pollution *

By H. M. Ely, Superintendent of Water Company, Danville, Ill.

IN Illinois the number of cities having surface supplies is 67, only 16 of which are filtered. It would seem to be fair that the community casting its sewage into a stream should clarify it to a reasonable extent that the cost of handling its sewage should not be borne entirely by the next community below which depends on the river for its water supply.

The legal principles are thus classified:

1. Rights of riparian owners to pure water as against one another.
2. Right of public as distinguished from individual owners to have inland waters kept free from pollution.
3. Conditions and extent of use of inland waters for disposing of sewage permissible to municipalities.

Rights of riparian owners are guarded by the common law. Rights of public to prevention of pollution and to dispose of sewage properly are sought to be defined by the anti-stream pollution laws.

Every riparian owner has the right to use the water running over his land but has no right to pollute it to the injury of those below him. This has been confirmed by such decisions as The Indian Refining Co. v. The Commonwealth, Franklin County, Ky.

The municipality has no more right than a riparian owner to pollute a water supply injuriously, but it is advisable to have specific laws that the matter may be more minutely defined than it can be by the results of injunction suits and the like.

The Federal government has no authority to prevent the pollution even of streams which may be termed interstate streams, but recognizes the jurisdiction of the states. Bills have been introduced in Congress providing for the study of the problem but none have yet been passed.

Minnesota's State Board of Health has general charge of all springs, wells, ponds and streams used for water supply for domestic use and her authority to preserve them from pollution endangering the public health. No sewage which will impair the healthfulness of water can be deposited where it will drain into a source of water supply. Appeal to district court is permitted.

Wisconsin provides that water supply and sewage plans of cities must be submitted to the State Board of Health for approval and certificate as to whether the works will be unsanitary or dangerous to public health. There is no relief from present sewage discharge. A more specific law is desired.

Rhode Island's State Board of Health can enjoin the placing of polluted matter on the watersheds of streams used as public water supplies, but has no control over the use of such streams or over sewage disposal.

Maryland's Board of Health has pro-

* Abstract of a paper before the Illinois Sanitary and Water Supply Association.

cured a number of injunctions under a law making the pollution of a water supply sufficient to make it unfit for domestic use a misdemeanor with a $200 fine.

Vermont gives its State Board of Health oversight over public water supplies and authority to prohibit use of polluted sources of water supply, with the approval of the Court of Chancery.

New York's State Health Commissioner can make rules for government of pollution of watershed of streams used as water supplies but cannot as yet order existing sewage pollution removed.

Massachusetts has the strongest stream pollution laws. Its State Board of Health may examine into purity and fitness of water supply for domestic use and make regulations for sanitary protection thereof. Plans for water supply, sewerage and disposal must be approved by the Board. Pollution of water supply may be prohibited. Supreme or Superior Courts have jurisdiction to enforce orders of Board, and to enjoin violations of their rules on application by city or private person or corporation. The Board must examine annually all main outlets of sewerage and disposal. Cities can take lands about sources of water supply for purposes of protection. The Board may require enlargement, improvement and proper maintenance of existing sewage disposal works. Manufacturing waste detrimental to sewage purification process may be kept out of sewers.

Pennsylvania laws are similar to those of New York. They prohibit discharges of sewage into streams, except such as were already in existence and concerning which satisfactory reports of effects on sanitary conditions are made. Whenever such sewage discharge becomes injurious to public health it can be stopped by the State Board of Health. Permits to discharge sewage may be issued when deemed permissible by governor, attorney general and State commissioner of health. Decisions can be appealed from to a court of common pleas in the county in which the sewage outlet is located. Fines may be assessed for violation of laws.

Kansas has a similar law to that in Pennsylvania, except that the power of the Board in requiring improvements in water supplies is limited.

New Jersey laws are specific regarding sewage disposal. Cities have right to condemn lands for sewage disposal plants. There are several drainage and sewage disposal commissions to which have been assigned various districts for installing sewage disposal plants.

Ohio laws give the State Board of Health control over effluents of water and sewage purification works and power to enforce competent supervision and efficient operation. Methods of raising funds for sewage and water purification plants are fully provided.

Indiana has a law similar to that in Ohio, not yet enforced for lack of necessary appropriations.

As to enforcement of these laws reports are as follows:

Pennsylvania enforces its laws very strenuously.

The first New Jersey case is now in court, but many improvements have been made on notice without suits.

The Ohio Board has issued five orders to install sewage purification plants and two for water purification. It is now under a temporary restraining order, the constitutionality of the act having been attacked.

Kansas reports the laws well enforced. Twenty-six sewage purification plants are now in operation or under construction. Two water supplies have been ordered purified.

Illinois has no law of general application and is attempting the passage of acts similar to those of Ohio and Indiana.

Settling basins or septic tanks for the purification of sewage are in operation in the following Illinois cities: Aledo, Belleville, Champaign, Collinsville, DuQuoin, Harvard, Highland Park, Naperville, Paris, Polo, Upper Alton, Urbana, Wheaton and Woodstock.

# Bituminous Materials in Road Construction and Maintenance*

By Prof. Arthur H. Blanchard, Consulting Highway Engineer, Brown University, Providence, R. I.

THE development of the use of bituminous materials in the construction and maintenance of roads in the United States since 1908 is worthy of careful consideration and critical analysis.

The bituminous materials which have been used in the United States during the past three years may be classified as follows: Fluxed native asphalts, oil-asphalts, residual asphaltic and semi-asphaltic oils, light oils; coke-oven tars, coal-gas tars, water-gas tars, and combinations of coal-gas and water-gas tars; combinations of asphaltic materials and tars.

The nomenclature used to designate the various kinds of tars is self explanatory. In order to avoid misunderstanding the terms used in connection with asphaltic materials will be defined, the definitions given being abstracts of those proposed by Prevost Hubbard, chemist, United States Office of Public Roads.

"Fluxed native asphalts are native asphalts fluxed with a heavy petroleum residuum. Native asphalts are solid or semi-solid native bitumens, consisting of a mixture of hydrocarbons of complex structure, free from any appreciable amount of solid paraffins, melting upon the application of heat and evidently produced by nature from petroleums containing little or no solid paraffins. Unrefined native asphalts with few exceptions contain water, vegetable matter, clay, sand, etc.

"Oil asphalts are solid or semi-solid products produced by the distillation of semi-asphaltic and asphaltic petroleums.

"Residual asphaltic and semi-asphaltic oils are heavy viscous residues produced by the evaporation or distillation of crude asphaltic and semi-asphaltic petroleums until at least all of the burning oils have been removed and often some of the heavier distillates as well.

"The term light oils includes crude and partially refined paraffin petroleums, semi-asphaltic petroleums and asphaltic petroleums.

"Paraffin petroleum is an oil the base of which is composed principally of the paraffin hydrocarbons.

"Semi-asphaltic petroleums are oils containing a semi-asphaltic base, i. e., oils whose residues produced by evaporation or distillation, while composed mainly of asphaltic hydrocarbons, contain also a certain percentage of paraffin wax.

"Asphaltic petroleums are oils containing an asphaltic base, i. e., they are capable of producing residues very similar to native asphalts if evaporated or distilled down to the consistency of such asphalts. They contain little or no solid paraffins. Native asphalts are probably produced from such oils by natural processes."

As typical of the practice in the United States will be cited the work of seven State Highway Departments which have used bituminous materials extensively. The writer wishes at this time publicly to thank the Highway Departments of the States mentioned below for their co-operation in collating the following information. The figures given refer to the total amount of work of the various types indicated which has been accomplished in 1908, 1909 and 1910 by the State Highway Departments of the States of Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania and Rhode Island. The work has been classified on the basis of the method employed and the kind of material used. Three general methods are referred to; namely, superficial treatment of roads constructed of ordinary macadam or gravel, the construction of bituminous pavements by penetration methods, and the construction of bituminous pavements by mixing methods. The bituminous materials employed have been classified in three groups: first, tars and tar-asphalt compounds; second, fluxed native asphalts, oil-asphalts and residual asphaltic and semi-asphaltic oils; third, light oils.

The following tables give the amount in square yards of surfaces treated and bituminous pavements constructed by the State Highway Departments men-

* A paper before Section D of the American Association for the Advancement of Science.

tioned above during the years 1908, 1909 and 1910.

*Superficial Treatment of Roads.*

| | Tar and Tar-Asphalt Compounds. | Fluxed Native Asphalts, Oil Asphalts and Residual Asphaltic and Semi-asphaltic Oils. | Light Oils. |
|---|---|---|---|
| 1908 | 57,700 sq. yds. | 239,500 sq. yds. | ..... |
| 1909 | 95,500 sq. yds. | 910,600 sq. yds. | 4,125,900 sq. yds. |
| 1910 | 123,400 sq. yds. | 2,434,200 sq. yds. | 9,890,400 sq. yds. |

*Bituminous Pavements Constructed by Penetration Methods.*

| | Tar and Tar-Asphalt Compounds. | Fluxed Native Asphalts, Oil Asphalts and Residual Asphaltic and Semi-asphaltic Oils. | Light Oils. |
|---|---|---|---|
| 1908 | 37,800 sq. yds. | 25,200 sq. yds. | ..... |
| 1909 | 170,200 sq. yds. | 2,077,400 sq. yds. | ..... |
| 1910 | 339,300 sq. yds. | 4,840,200 sq. yds. | 26,500 sq. yds. |

*Bituminous Pavements Constructed by Mixing Methods.*

| | Tars and Tar-Asphalt Compounds. | Fluxed Native Asphalts, Oil Asphalts and Residual Asphaltic and Semi-asphaltic Oils. | Light Oils. |
|---|---|---|---|
| 1908 | 52,100 sq. yds. | 4,400 sq. yds. | ..... |
| 1909 | 136,000 sq. yds. | 219,500 sq. yds. | ..... |
| 1910 | 158,000 sq. yds. | 432,600 sq. yds. | ..... |

It is interesting to note from the standpoint of the general increase in the use of bituminous materials in the States cited that in 1908 bituminous materials were employed in the construction and maintenance of 416,000 square yards of road surfaces, in 1909 of 7,734,000 square yards and in 1910 of 18,244,000 square yards. Although the construction of bituminous pavements is in its infancy in the United States, remarkable progress is being accomplished in certain sections. For instance, by the close of the construction season of 1911, if the plans of the State Highway Commission are carried out, the State of New York will have a trunk highway with a bituminous surface extending north from New York City to Albany and thence west to Buffalo aggregating over 400 miles in length.

In the surface treatment of macadam and gravel roads, several lines of development have been especially noticed: first, a more general use of refined coal-gas and water-gas tars in place of crude tars; second, an extraordinary increase in the various kinds of heavy asphaltic oils, combined with sand, gravel or stone chips to form a carpet wearing surface; third, an increase in the use of light oils for the purpose of allaying dust on state roads and thus, to a certain extent, preserving the surface of the road by the retention of the top dressing; fourth, a substitution of mechanical distributers of both the pressure spray and gravity flow type in place of hand application methods.

The practice of the past three years has amply demonstrated that the success of superficial tarring is dependent upon the recognition and adoption of those fundamental principles which were laid down by the French engineers in 1903. As those principles have not been adopted in many instances in the United States, they will be given here in brief. First, superficial tarring should be done only during dry and warm weather in order to obtain efficient and economical results; second, the road must have a dry, smooth and durable surface; third, all dust must be thoroughly brushed off in order to facilitate the adherence of the tar; fourth, after the distribution of the coat of tar it is necessary, in order to avoid a slippery surface, to apply a dressing of sand, gravel or stone chips. The practice of some prominent English engineers does not include the adoption of the fourth recommendation cited, as it is maintained that a top

dressing is not an essential element of a non-slippery tarred surface.

A well developed plan of annually treating certain roads of a system with a thin coat of bituminous material is being adopted in certain states. This practice embodies the recognition of the fundamental principles of economy and efficiency in modern highway construction; namely, the adaptation of method and material to local conditions.

In connection with the use of bituminous materials by penetration methods certain noteworthy tendencies are apparent. Most important are the employment of distributing apparatus and the formation of broken stone courses in such a manner as to endeavor to secure the maximum uniformity of distribution of material and the definite limitation of penetration.

The average size of stone employed varies from ½ inch or ¾ inch in longest dimensions to 1¼ inch to 1¾ inch. In exceptional cases, however, engineers have adopted the English and French practice of using larger and more uniform sizes of stone for the top course. The unfortunate delays in the application of the penetration method due to damp stone have been overcome in some instances by the employment of mechanical surface heaters.

A modification of the penetration method is known as the "puddling method." The top course in this case is filled with screenings, puddled by watering, and thoroughly rolled. After the surface dries out it is picked up. The bituminous material is then applied, a coat of chips is spread and the surface rolled. After the surplus chips are brushed off, a flush coat of bituminous material is applied. The application of another coat of chips and a final rolling complete the process.

Another modification of the regular penetration method has been employed during 1910. In this method the foundation is thoroughly filled and rolled. A layer of sand is spread upon the foundation course to a depth of about one inch. Refined tar heated to about 250 degrees F. is then applied to the coat of sand. The top course composed of broken stone varying from ¾ inch to 2¾ inches in diameter is spread and rolled, the lower voids being filled with the bituminous mastic. After consolidation a second coat of refined tar is applied. As soon as possible after spreading the second coat of tar a layer of stone chips is spread and rolled. A third coat of refined tar is then applied and the surface finished by rolling a covering of screenings or sand.

In the reconstruction of old roads there has been a general employment of the method of picking up the old surface to a depth of 2 inches to 4 inches by the use of mechanical scarifiers, placing a thin coat of new road metal on the loosened surface, and then constructing a bituminous pavement by the penetration method.

In both the construction and reconstruction of roads by penetration methods the surface is finished in various ways. One method is to spread a coat of chips or sand after the first coat of bituminous material is applied, roll thoroughly and after the road has set up sufficiently open it to traffic. Another method is to apply a second coat of bituminous material for the flush coat, which may or may not be the same as used for the first coat. A layer of chips or sand is then spread over the flush coat and thoroughly rolled. A third method is essentially the same as the second method cited except that a layer of chips is applied to the first coat of bituminous material, thoroughly rolled and the surplus chips brushed off before the application of the flush coat of bituminous material.

From the standpoint of the character of bituminous material used it is of special interest to note the increased use, particularly in 1909 and 1910, of fluxed natural asphalts and oil-asphalts especially manufactured for application to unheated crusher run stone.

In the construction of bituminous pavements by the mixing method a number of improvements and developments should be noted. Some attention has been paid to having the stone dry and reasonably clean. Although the advantages accruing by using clean and dry stone are recognized, the practice has been far from satisfactory, only very crude methods having thus far been employed. The practice of heating stone on plates has been used to a certain extent with deleterious results. In a few cases mixing machines and tar coating machines have been employed in connection with the construction of bituminous pavements which are to cost not over $0.90 to $1.00 per square yard. The types of the mixers which have been used to date are more or less unsatisfactory, especially when bituminous materials are used which are solid at ordinary temperatures or which flow with considerable difficulty when cold. During the season of 1911 considerable devel-

opment should take place in the heating of stone by mechanical dryers and also in the use of new types of mixers especially manufactured for the purpose of mixing bituminous materials with a mineral aggregate.

The mixing of broken stone or other aggregate with bituminous materials at a central plant and shipping the finished product by rail has not been developed to any extent in this country. The product of one company, however, has been used quite extensively in three or four states. In another case refined asphaltic petroleums have been mixed with sand and gravel and molded into blocks at a central plant. The blocks have been laid as the wearing surface and rolled.

Bituminous pavements constructed by mixing methods have been finished in different ways. In certain instances satisfactory results have been attained by applying a coat of chips or sand to the surface of the course of mixed aggregate and thoroughly rolling the same. In other cases a flush coat of bituminous material has been applied before the layer of mineral matter is spread over the surface. The bituminous material used for the flush coat in many bituminous pavements is not the same as was used in the mix.

In the above discussion of the mixing method it should be noted that the remarks do not in general apply to bituminous pavements constructed by mixing a carefully graded aggregate and bituminous materials, and hence do not refer to many types of bituminous pavements which have been used to a considerable extent in the construction of streets in municipalities.

In various parts of the United States sand, gravel and earth have been mixed in place by various processes with bituminous materials in the endeavor to form an impervious, dustless and durable road surface. This work is being watched with considerable interest, as the utilization of local materials for the aggregate in many instances reduces the coast of construction materially. The limitation in the weight of traffic to be carried throughout the year under all climatic conditions is one of the most important points under discussion at the present time in connection with the above methods.

A new type of construction recently introduced by Logan Waller Page, Director of the United States Office of Public Roads, is known as oil-cement concrete. In this process fluid residual petroleum is added to the usual ingredients composing concrete.

From the standpoint of the nature of the material used, again it is noted that there is an increase in the use of refined tar, considerable employment of heavy asphaltic compounds and also the employment of combinations of tar and asphalt, the most noticeable increase, however, being in the use of heavy asphaltic oils which can be mixed readily with broken stone as it comes from the crusher.

There has been a marked tendency on the part of highway engineers during the past three years to appreciate more fully the importance of the various chemical and physical properties of bituminous materials. Many engineers and manufacturers now wisely advocate using different grades of the same type of bituminous material for varying local conditions and for different methods of bituminous construction. During 1909 and 1910 bituminous materials for use in the construction and maintenance of roads have been purchased in two ways; namely, by buying direct from the manufacturer a product known under a trade name and purchasing the material under specifications. The old custom of simply purchasing bituminous material under a trade name without investigation of its properties is being replaced by the second method. The object of the second method has been to cover one or more of the following points: first, to secure uniformity in the material furnished for a given contract; second, to obtain a compound which conforms to certain requirements with reference to the chemical and physical properties of the material which are considered essential; third, to provide a standard by which it is hoped that a satisfactory material may be duplicated on other contracts. The effect of the various physical and chemical properties of bituminous materials on their value as road binders is being investigated by a special committee of the American Society of Civil Engineers. Standard methods of testing bituminous materials is the subject of investigation by a sub-committee of the American Society for Testing Materials.

In this country, as well as in Europe, considerable confusion results due to the lack of uniformity among engineers, chemists and manufacturers relative to the nomenclature of bituminous materials. Until a recognized nomenclature is adopted it will be advisable to define methods and materials in order to avoid misinterpretation of information furnished relative to the construction and maintenance of bituminous surfaces and bituminous pavements.

# Modern Municipal Sanitation in Cuba*

By R. Winthrop Pratt, Chief Engineer of the State Board of Health, Columbus, O.

AFTER the Spanish war and during the first American intervention, under General Leonard Wood, sweeping reforms were instituted in all of the cities of the Island of Cuba in regard to water supplies, sewerage, street cleaning, and the collecting and disposing of garbage. Owing to the importance of controlling yellow fever, which was particularly fatal to foreigners, as well as for general sanitary reasons, the work inaugurated at this time was very thorough; and has served as the basis for the continuance of sanitary work since Cuba commenced to govern herself.

The construction of municipal works has been facilitated by the fact that appropriations therefor come from the national treasury and not from the cities and towns. The latter depend upon local taxes for their income and these amount to barely enough to cover running expenses. The funds of the National Government, received through the custom house, must therefore be used. This condition has the advantage of permitting the central government to direct the work under the best obtainable engineering advice, and to adopt uniform policies with reference to the various localities.

Similarly the execution of all health laws is under the supervision of the National Department of Health and Charities, the secretary of which is a member of the President's cabinet. In immediate charge is the director of sanitation, who supervises the local health officers and health departments; all being paid from the national treasury. Each local health officer has, among other responsibilities, full charge of street cleaning and sprinkling; removal of garbage; disinfection, (both public and private); and the petrolization of mosquito breeding places.

In Havana, (as well as in the other cities and villages) the streets are now very clean and the principal ones are kept well sprinkled.

A box of garbage from each household is placed every evening on the sidewalk in front of the house and is collected during the night and hauled to a loading wharf, where it is dumped on to a garbage scow. Later it is taken out into the gulf stream three miles or more from shore, depending on the wind, and there unloaded. During the first American intervention, a large number of substantial galvanized iron garbage cans were purchased; but owing to the very narrow streets and sidewalks, it was found that these cans were usually knocked over by wagons or kicked over by pedestrians, so that their life was not long. Moreover, many of them were stolen. Since then the custom has been to use small uncovered wooden boxes. Of course, these are not as neat as the covered can and a great deal of the garbage is strewn about the streets by dogs and cats. Nevertheless by having the street cleaner promptly follow the garbage collector, the streets are kept in a clean condition.

The principal work of the disinfection department consists primarily in the regular application of a disinfectant, or deodorizer, hauled about in a tank wagon, to the storm water inlets in the old drains which are in effect combined sewers. In addition this department stands ready to disinfect private dwellings where there have been cases of infectious disease.

Allied to the disinfection work there is a division which is devoted to the elimination of mosquitoes, its work being primarily of great importance as an aid in controlling yellow fever; but also a great comfort to many residents who would otherwise be annoyed by mosquitoes. The employees of this division, armed with cans of crude petroleum and note books, not only apply oil to swamps and low lands, but also make continuously a house to house inspection in search of any stagnant water which might afford opportunity for mosquito breeding. Suspicious places in houses or yards are sprinkled with oil; and any gross neglect or disobedience of previous orders on the part of the householder is noted with reference to imposing a fine, which may be collected by the local health officer. Some over-zealous inspectors have been known to condemn water standing in a vase of flowers or in the drip pan under an ice chest. On the whole,

*A paper before the American Society of Municipal Improvements.

however, the work is intelligently carried out and is of great benefit.

In connection with mosquito elimination the health department is given authority to fill and drain low swampy places within municipalities and assess the cost upon those benefited. Also, projects have been made for reclaiming and draining large swamps at the borders of some of the cities.

Another important branch of the municipal health service in Havana and surrounding villages, is the division of plumbing inspection. Plumbing in all public and private buildings must be executed according to definite regulations; plans for each installation must first be approved by the local health officer on recommendation of the chief inspector. No master plumber can work without first passing an examination and obtaining a license from the health department. This service has resulted in a wonderful improvement in house sanitation.

The most important construction work planned, by the Americans, as part of the general policy of improved municipal sanitation is the new sewerage system and street paving for the city of Havana, which works are to cost at least $16,000,000.

The plans for the new sewerage system were prepared under the general direction of the United States Military Engineers, assisted by the expert advice of Mr. David H. McComb of Washington, D. C. and Mr. Samuel M. Gray of Providence, R. I. Mr. McComb is now chief engineer in charge of the execution of the work.

The sewer system is designed entirely upon the separate plan. Storm water drains are to discharge into the harbor or into the gulf at a number of convenient points; while the domestic sewers will terminate in a screen chamber at the edge of the harbor from which the screened sewage will pass underneath the harbor through an inverted siphon, about one-quarter mile long, to a pumping station, located a short distance south of Cabanas Fortress. At this point the sewage will be raised by centrifugal pumps into a 7-foot masonry tunnel about a mile long passing under the abrupt and rocky peninsular which forms the northeasterly side of Havana harbor and upon which is located the well known Morro Castle. The tunnel terminates at an outfall chamber, from which a cast-iron flanged pipe, five feet in diameter and some 500 feet long will extend into the swift current of the gulf stream, and there discharge the sewage at a depth of some 30 feet below the surface. The total length of sewers will be about 180 moles.

The smaller sewers will be of standard vitrified pipe and above that the larger ones will be either of concrete lined with a single row of brick or of reinforced concrete. Two of the outlying districts are so located that the domestic sewage will have to be collected at subsidiary pumping stations and from there raised into the main system and conveyed to the outfall.

Owing to the very narrow streets in the older portion of the city, and also to the fact that most of the sewers in this district are below the harbor, there have been a number of constructional difficulties to contend with. Nevertheless fair progress is being made and it is probable that within five or six years Havana can be classed as a well sewered city.

Special stress is laid in the contract to keep the open trenches at all times in a sanitary, and as far as possible odorless condition. The contractor is directed to use chloride of lime in a specified proportion. While these precautions have not been successful in entirely eliminating the odors, it is believed that conditions are better than in many American cities where new sewers are constructed in old and crowded districts. The principal source of odor in the Havana work seems to originate from the connecting of old sewers and cesspools into the new sewers rather than from any foul odor inherent in the sub-soil. Such odor in the sub-soil was expected by some in view of the fact that it has been continuously polluted for some 300 years.

Outside of Havana there has been very little sewerage construction under either American or Cuban administrations since 1898, except at Cienfuegos and Santiago. At the former place a complete system of sewers, built under a special decree of the former provincial governor, is nearly completed. The original plans for this system included a septic tank as a means of treating the sewage; but it was later decided, after a more thorough study of the currents and available dilution in the harbor, to omit the tank and substitute a mechanical screening plant.

At Santiago there were built during the first American intervention several miles of sewers and also a pumping station and equipment; but owing to many changes of administration and and lack of funds, the outlet sewer has never been built; consequently the

finished work is useless and the pumping machinery is rapidly deteriorating through non-use and lack of care.

Referring to the places where water supply construction has been performed since 1898, there may be mentioned Cienfuegos, Santiago and Camaguey. Plans have been prepared for supplies for many other places; and the necessary funds have been promised by political leaders but have never been forthcoming.

At Santiago, (since American intervention) the old supply has been abandoned and there has been constructed a large impounding reservoir holding 444,400,000 gallons, formed by an earthen dam 60 feet high and 700 feet long with concrete core walls.

This reservoir was completed in 1908. During the past year, under the general direction of the writer, there have been prepared complete plans for a mechanical filtration plant to purify the water from this new supply, and it is hoped that this piant will be built during the coming year. The total cost of water works improvements at Santiago since the American intervention has been at least $1,500,000.

At Camaguey, which is located in the central part of Cuba, a very complete water works is about completed. This was designed and carried out principally by American engineers. The supply is from a creek, 14 miles north of the town, which is stored in an impounding reservoir holding only four months supply and formed by a reinforced concrete dam, 33 feet high and 840 feet long. The total cost of this work will be about $1,000,000.

In closing it may be said that sanitation in Cuban cities compares very favorably with, and in some cases is superior to, that in American cities of equal size. On the other hand, the warm climate and other local conditions in Cuba compel more activity on the part of the municipal officers, than is the case with cities in this country. Proper sanitation in Cuba is of concern not only to herself, but to the United States and to other nations having large commercial interests in the Island. It is, therefore, probable that the standards established under American administration will be maintained.

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# Relation of Bridge Specifications to Highway Improvement*

By Professor Albert Smith, Purdue University, Lafayette, Ind.

THE Indiana Engineering Society, in co-operation with several other organizations in this state, and supported by a great volume of public opinion, is urging upon the state legislature the establishment of a state highway commission.

No one of us doubt that some time in the near future, if not actually at this season, such a commission will be teen ton road-rollers as an alternative loading. Reports from manufacturing firms give the weights of the heaviest road-rollers as from 30,000 to 42,000 pounds. These weights and the distribution of the load will be shown on Table I.

Road rollers are not the only heavy loads that may come on highway bridges. In Table I are given also the weights on drivers of the heaviest road locomotives now in use in the west. We have not in this part of the country used such heavy engines, and we still haul with horses. The conditions of agriculture in this country are changing. The decrease of rural population and the accompanying increase in the value of farm property are the signs of the age of machinery on the farm. We are pretty certain to see the day when the traction engines on our highways will be much heavier than those now running. The use of the roads by such engines is likely also to established. The lack of some general organization of highway repair and improvement causes a waste which increases year by year. When such a commission is organized, the first obstacle which its plans for improvement will encounter is the fact that very many of the bridges on highways which should be among the first improved are unable to safely bear the the machinery of improvement. That new bridges unsafe for road-making machinery should be put in, while such

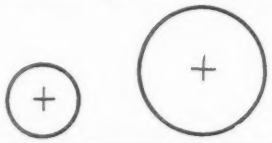
*A paper before the Indiana Engineering Society, January 13, 1911.

a movement is in progress, is a folly which no present shortage of funds can condone. The certainty that the bridges on all our main highways will be called on to endure road-roller loads within a period well inside the life of any steel bridge now building makes it improper to neglect such loads in their design.

which for the 21-ton roller above gives 7,100.

Below are given the lengths of I-beams in which the fibre stress from a concentrated load of 7,100 lbs. and the floor weight is 16,000 lbs. per square inch.

For the stringer spacing above, 8-inch I's in 16-inch panels with wooden



| | | | |
|---|---|---|---|
| Road Rollers | | | |
| (Name witheld) | 21 T. | 14000 | 28000 |
| Buff Steam Roller Co | 20 T. | 16000 | 24000 |
| Austin Western Co | 15 T. | 8000 | 22000 |
| Iroquois | 13 T. | 8000 | 18000 |
| Traction Engines | | | |
| J. I. Case | 110 HP | | 31500 |
| Rumely Co | 120 HP | | 31000 |
| Avery Co | 90 HP | | 24000 |
| Case | 75 HP | | 20400 |

TABLE I. WEIGHTS ON ROAD ROLLER AND TRACTION ENGINE AXLES.
Giving weight of roller and weight of each axle for the road rollers and traction engines named.

The highway bridge specifications of those states whose highway work is most thoroughly organized specify fifdemand the use of the heavier road rollers in construction.

The most common spacing for stringers of country highway bridges is 2 feet 8 inches. The tread of the 21-ton roller above is 94 inches. On plank floor it will not be safe to assume the load carried to more than half of one stringer space on either side. Calling the tread "t," the stringer spacing "s" and the weight of the wheel "w," the load on one stringer will be expressed by:

$$P = \frac{w\,s}{(t+s)}$$

floors have, under this road roller, a a fibre stress of about 25,000, which is very large. With a concrete floor of 110 lbs. per square foot it would have 31,900.

It is very probable that, in view of the fact that so many of our bridges are too light in the floor for 20-ton rollers, few of them will be used on our road improvement. Even the 15-ton road roller given above has 22,000 on its rear wheels, would produce deflections in an 8-inch I, 16 feet long, sufficient to crack the concrete arches badly, aside from the doubtful security of steel members with a fibre stress of 25,000 lbs. produced mainly by moving load.

Granted the most favorable circumstances—that we use only 10-ton road rollers—for the present, we cannot be sure that developments in the practice of road making may not make it extremely desirable in the future to use the heavier rollers, on the more important roads. I am strongly of the opinion that, in the absence of any state specifications in regard to this matter, we ought to design stringers gine on the bridge floor. The driver of the engine drew it up beside one truss to take water from the stream, and when his tank was full turned toward the center of the bridge and started his engine. The force necessary to overturn these stringers must have been very large and it would seem that this is a thing likely to occur at any time. It is tolerably easy to secure the stringers against such forces, but it

| Size | Length Wood Fl. | Length Concrete Fl. |
|---|---|---|
| 7" I | 7'-9" | 6'-8" |
| 8" I | 10'-6" | 9'-0" |
| 9" I | 13'-9" | 11'-6" |
| 10" I | 17'-7" | 14'-3" |
| 12" I | 26'-0" | 19'-5" |
| 15" I | 40'-0" | 27'-4" |

TABLE II. RELATION OF SIZE AND LENGTH OF I-BEAMS HAVING 16000 LBS. MAXIMUM FIBRE STRESS.

| Span | Beam | Deck Girder | Through Girder | Truss |
|---|---|---|---|---|
| 20 | 3000 | 4100 | 4400 | |
| 30 | 7100 | 6700 | 7800 | |
| 40 | 12100 | 9900 | 11700 | 10600 |
| 50 | | 15800 | 18000 | 13400 |
| 60 | | 21100 | 23700 | 16300 |
| 70 | | 27400 | 30600 | 20400 |
| 80 | | 34000 | 40000 | 25000 |

TABLE III. WEIGHTS OF STEEL IN GIRDERS AND TRUSSES.

spaced 32 inches apart for a load of 6,000 lbs. on one stringer concentrated at the center of the panel, and for a fibre stress of 16,000 lbs. per sq. in.

Road roller loadings do not ordinarily produce stresses in the truss members of a bridge equal to those from uniform live loads. There is one action of heavy road machines which is not, I believe, ordinarily considered, at least has not been by the writer. A short time ago a young man brought me a sketch of a highway bridge whose stringers has been tipped over sidewise by the turning of a traction engine on the bridge floor. The driver of the engine drew it up beside one truss to take water from the stream, and when his tank was full turned toward the center of the bridge and started his engine. The force necessary to overturn these stringers must have been very large and it would seem that this is a thing likely to occur at any time. It is tolerably easy to secure the stringers against such forces, but it made me wonder if almost any pony highway truss were not in some danger from such a test. A pony highway truss is not any too secure at any time, and when you conceive a heavy concentrated load which causes nearly the maximum stress in the top chord, suddenly deflected by hitting the wheel guard on the side, you are moved either to wish you had not been the designer or to be glad you were not, as the case may be.

I believe the supposed economy of the pony truss over beam-spans or plate girders to be a mistake. In in-

vestigating the subject, I have made some combinations of the weights of bridges given in Ketcham's Bridges. These weights are taken from tables furnished by the Boston Bridge Works and the American Bridge Company. In order to compare the total steel weights I have added a floor of 7-inch I's to the spans below 40 feet and 8-inch I's for spans above 40 feet.

Above is the table of total steel weights, the beam spans directly from the tables, the girders and trusses by combination and the addition of the joists.

The cost of fabrication and erection varies so with different shops that one can hardly propose a figure that would be accepted by everybody, but it seems pretty clear that 1,700 lbs. of steel would not pay for the difference between the cost of shop work and erection of a 40-ft. truss beam bridge. At ¾ cent a pound the saving in 10,000 lbs. is $80.00, which buys the steel three times.

For 50-ft. trusses the saving from trusses appears to be 4,600 lbs. The saving in shop work of plate girders is less than in beam spans, yet it is considerable. J. A. L. Waddell several years ago proposed before the American Society of Civil Engineers the difference of ½ cent per pound as the difference between the cost per pound of girders and trusses. At this rate the saving from shop work in 50-foot spans appears to be $67, which will very nearly buy the extra steel. For deck girders the cost appears to be less, both for 50 and 60-foot girders.

Half through trusses can be built so that there is no question about their security, but where the only stiffening of the top chord consists of the bearing of the ends of the vertical posts on the floor beams, held tightly (at least at first) by "U" bolts, the security of a compression member 50 to 70 feet long is problematical, when it gets anything approaching a working stress. The writer has heard many men driving traction engines speak of "going around" to avoid light bridges, but none of those were plate girders. One has only to shake the top chord of a pony truss to see how loosely it is secured laterally, and to demonstrate its lack of fixity at intermediate points. A 30 or 40-foot truss bridge seems a little absurd to the writer, who has been unable to see any motive for building them at present beyond a desire to make a show for your money.

As for longer trusses, is not the money well spent that gives additional security and permanence?

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## The Concrete Outlet Sewer at Fort Smith, Ark.

By Matt and Bemis, General Contractors, Seward, Neb.

WE constructed last season the storm sewer terminal outlet for the Board of Public Improvement of Fort Smith, Ark., commencing the work the latter part of September, 1909, and completing it in February, 1910. This was a large concrete sewer, 11 feet feet and 9 inches inside diameter, built with wooden forms in the trench, and of concrete composed of 1-3-5 mixture, and was 1,320 feet in length, including the spillway.

To construct this sewer required a trench 14 feet wide and 27 feet deep to be excavated. The first ten feet of the excavation we took out with teams and slips, and the balance was removed with a cable-way, with tubs having a yard capacity, into which the dirt was shoveled by men. The tubs were carried back by the cable and dumped on the finished work. In this way we had only about 150 feet of trench to backfill at the completion of the sewer construction.

The weather was favorable during the entire period, with the exception of two weeks in January, when the mercury went down to zero, and stopped the concrete work.

The difficult part of the work was the putting in of the spillway. This was planned so that the bulkhead at the end would be below low water mark in the Arkansas river, into which the sewer emptied. Here we encountered water and quick-sand, but by cribbing the excavation with 2¼-inch tongue and groove flooring, we were enabled to keep the water and sand out until we could get the concrete placed.

Accompanying is a reproduction of

a snapshot showing the end of the sewer and the upper end of the spillway, taken when we had constructed 400 feet of the sewer. The forms can easily be seen at the upper end of the work. No reinforcement was used in the construction.

OUTLET SEWER, FORT SMITH, ARK.

The concrete at the arch was 11¾ inches thick; at spring-line, 19 inches; at invert, 11¾ inches. The rock was quarried and crushed at a plant in the bluff about 100 rods from the work and the sand was taken from the river on the opposite shore and barged to the work. We placed two lines of bracing in the trench at 8-foot intervals, the lower string being 6x6-inch timbers and the upper 6x8-inch timbers. The first 14 feet of the cut was heavy clay and the balance an alluvial deposit, with some sand at the bottom.

This work was planned and supervised by Mr. George H. Myers, engineer for the Improvement Board. The construction was under the inspection of Mr. Bercher, a man of large experience in construction work himself, as contractor and superintendent, and as a consequence there was no friction as to ways and means of doing the work, all knowing just how the work should be handled and managed. The Board of Improvement consisted of three members, who were thorough business men, two of them being bankers and the other a manufacturer. Mr. Harry E. Kelley, being the active member of the Board, had the management of the affair, as to the Board.

# EDITORIAL COMMENT

**Licensing Civil Engineers—Contractors' Costs**

## LICENSING CIVIL ENGINEERS.

Numerous bills have been proposed and others have been introduced in various State legislatures, which have the object of controlling the practice of engineering in its various branches. The following abstracts of bills proposed by an Indiana engineer give the general features of most of these bills:

The provisions in the bill for a state board of examining engineers may be stated as follows: 1. Three civil engineers practicing in three branches, if practicable, thirty years old, in practice ten years and in actual charge of work in the state for three years, are to be appointed by the governor for six-year terms. 2. Officers of board and provision for quarterly examinations of applicants. 3. Expenses paid from fees paid into an examining engineers' fund or by appropriations. Compensation, $10 a day and expenses. 4. Examinations to be advertised in two engineering journals at least three issues each, but interim examinations may be provided for. Fee, $25, of which $20 is returned if candidate fails. Candidates must be twenty-five years old, residents of Indiana, of good moral character, employed as assistant in civil engineering work at least five years and in responsible charge of work at least one year, graduation from engineering school counting for two years. Examination to consist of investigation of record, training and general success of applicant, with written answers to all technical or other questions to be kept on permanent record. Board to establish grade of qualifications to which applicants and their papers must conform. Questions may be varied from time to time, and related to particular branches when occasion demands. Those now in practice may file affidavits of training, experience and class of work and length of practice, with license fee of $25, and receive license. Engineers immigrating from other states having similar examination standards may receive license on payment of fee. 5. Provides for issue of license. 6. No person shall be county surveyor, city or town engineer or hold any responsible position in charge of construction of public work, and no one shall practice as consulting engineer, civil engineer or surveyor, or design, lay out or be responsible for, except as assistant, any civil engineering work without license. 7. Fines of $50 to $500 for each violation of law.

The bill regarding appointment of city civil engineer provides that the mayor shall appoint him and put him under the board of public works, or the council in cities of fifth class. Salary, $2,500 to $3,500 in cities of first class; $2,000 to $2,500 in second class; $1,200 to $1,800 in third class; $1,000 to $1,500 in fourth class. The city engineer is also to receive additional compensation of one per cent. of the excess in cost of public improvements under his charge of $300,000 in cities of first class; $200,000 in second class; $150,000 in third class, and $100,000 in fourth class, payable on approval of final assessment rolls for improvements made after rolls to above amounts have been made. No engineer to receive more than $5,000 a year. The extra one per cent. is to be added to the assessment. Board to determine compensation due on unfinished work at date of termination of employment or end of year.

The latter bill seems to be a move in the right direction, for the compensation of city engineers in Indiana has never been commensurate with the responsibilities assumed and the work done. As a consequence good engineers will not accept the positions unless they can carry on a private business in connection therewith or take it

for the experience or to fill in an interim between more profitable employments. There are, of course, public-spirited exceptions to this rule, but they should not be required to suffer for their philanthropic acts.

A bill similar to the one first mentioned was introduced in the Colorado legislature. It goes somewhat more into detail, and differs slightly in some unimportant features and contains provisions for revocation of licenses.

The legislature of New York has under consideration three bills. One of these has a tendency to reduce the profession of civil engineering to the level of a trade, and would make it possible for one passing the examinations in one branch of civil engineering to practice in any other branch, whether competent or not, being in this respect no better than, if as good as, the Indiana bill above quoted. The other two are built on the lines of the form of statute prepared by a committee of the board of directors of the American Society of Civil Engineers. This bill details all branches of engineering as being affected by it, and provides, in much more detail than the proposed Indiana bill, for the examining board and the qualifications of its members, expenses, procedure, examinations, issue and revocation of license, penalties and exceptions. The scope of examinations is placed in the hands of the board, but there seems to be no restriction of the license to the practice of any particular branch or branches of the profession. Reciprocity with other states is provided for.

It will be seen that these bills are all based on the same principles, and vary only in details and in fullness.

The writer does not accept the principles on which the bills are based as correct, and, assuming them as valid, he cannot see that they are properly drawn and safeguarded to secure the results desired, namely, the protection of the engineering profession from dishonesty and incompetency, which have their chance now on account of the ignorance of employers, both public and private, of the differences between good and poor engineers and the necessity of discrimination between them if the resulting work is to be entirely satisfactory.

It seems to the writer that the State has the right to determine the qualifications of engineers engaged in public work, state, county or municipal, and that it is stretching its police powers well beyond their limits in extending its supervision of the competence of engineers into private affairs.

The exercise of trades which may affect the public injuriously if incompetent men attempt to do the work, whether for private or public employers, may be considered as subject to regulation under the police powers of the state, and barbers, plumbers, and even surveyors, may well be subject to examination. But draftsmen, for example, are not such direct public servants that the State can justly assume the necessity and therefore the right to specify their qualifications and the methods of determining them. Perhaps the fact that draftsmen, often poor workmen, masquerade as architects, gives a slight warrant for the regulation of the architects' profession which has been undertaken by several states, this warrant being based on the protection of the ignorant public from the consequences of its acceptance of the pretensions of such incompetents.

The states that have passed laws for the regulation of engineering practice have really covered the practice of surveying with only partial reference to the practice of engineering, and the bills proposed and those introduced in western state legislatures, except those above described, have been of similar nature.

When we come to the professions of architecture and engineering, as distinguished from the trades or handicrafts of surveyor, draftsman, builder, and the like, we pass beyond the field of legitimate state regulation, and the only excuse for restrictive measures of any sort is the expressed desire of members of those professions for protection from the pretensions of the incompetent masqueraders referred to.

The medical profession is the only one which, by the vote of practically

all its members, has demanded this protection, and as a consequence certain schools in that profession have been able to secure a protection which has worked injustice upon equally competent schools and has interfered with the general progress.

The regulation of the legal profession by the State is legitimate, for attorneys practice in the courts of the State, and thus come directly within its control. The State of Indiana, however, specifically excepts the legal profession from the control of the State legislature and makes such control by the courts themselves almost of no effect.

Most engineers recognize the propriety of the freedom of their profession from State control, perhaps without formulating the principle behind it, but none the less fully. But few organizations of engineers have put themselves behind a movement to secure such control. The American Society of Civil Engineers puts itself in the peculiar position of deprecating State control at the same time that it presents a form of bill which it prefers in case a State should desire to pass a controlling law. Unfortunately, this bill could not attain the desired end.

The writer has frequently presented a measure which seems to him to meet the legitimate demands of those on both sides of this question. It is based on the one hand on the undoubted right of the State to define the qualifications which its own employes or those of its subordinate corporations must possess. It recognizes, on the other hand, the right to freedom of the engineering profession in general.

In brief, it is proposed that the State, through a proper examining or civil service board, shall establish eligible lists, under classifications and regulations of its own, from which shall be appointed city engineers, their principal assistants, superintendents of streets, of water works, of lighting plants, engineers of highways, bridges, State structures, of the various State and county boards, etc. These lists should be varied enough to cover all the public engineering and architectural work in the State, construction, repair, maintenance and operation. The State board may provide for local aid in preparing eligible lists for minor appointments if it finds this desirable. The kind of examination should be left entirely to the board. Certificates giving date of examination, kind of examination, classes of position for which it is given, should be given to each candidate successful in getting his name on an eligible list. He then has a certificate equal in all respects, so far as it goes, to a license from the State, except that it does not exclude from practice those not holding such certificates, although it does exclude those not holding them from appointment to the public offices coming under its class.

A competent examining board will soon establish a reputation for choosing competent men for its lists, and judicious advertising of the qualities to be expected of engineers on the various lists, and of the differences in these qualities for the various lists, will soon cause employers of engineers to demand, as a first requisite of employment for responsible positions, the possession of a certificate for a list which will cover approximately the qualifications required for the position to be filled. Thus the State's certificate will answer all the good purposes of a license and will not have any of its objectionable features.

An engineer can, of course, secure places on as many of the lists as he desires and can qualify for. Thus the certificates will definitely state the work for which the engineer has shown his competence, and will not be open to the very serious objection made to the bill of the American Society of Civil Engineers, namely, that it allows the issue to an engineer qualified in one branch of engineering of a license which would permit him to practice any branch of engineering. It is often true, for example, that an engineer fully competent to design and construct sewers would be too ignorant of electrical engineering to choose intelligently a motor for a given duty. Such a law is scarcely a protection of the pro-

fession against dishonest incompetency.

Unfortunately, membership in the national engineering societies has not always been a certificate of competence, and it is quite as indefinite in its statement of specific qualifications as the license proposed in the above quoted bills. Then, too, many competent engineers are not members of such societies and there are regions in which the number of members is very limited. Neither are the qualifications for membership under the control of the State.

It seems to the writer, therefore, that engineers will do their profession the most service if they will favor the passage of laws providing for well-selected eligible lists of men for appointment to public service positions, putting no limit on the number of examinations or to the number of names on the lists, and issuing certificates defining the nature of the qualifications covered by them. The public will then have a minimum standard of qualifications for its various classes of technical employes and private employers will have a means of determining the qualifications of the men presenting themselves for employment as engineers in any grade of work. They can then restrict themselves in making appointments as closely to these lists as they desire and will know the nature of the chances they take in making appointments outside of them. No engineer can object to the closing of the profession nor can he complain that it is reduced to the level of a trade. At the same time, the employer has all the advantages in making his choice that the license system would give him, and the public offices have the advantage of a close classification and the definite determination of qualifications thereunder.

## CONTRACTORS' COSTS.

The great importance of accurate knowledge of the cost of doing work to the contractor who has taken a contract or who is proposing to bid on a contract is more thoroughly recognized as the business of contracting develops and the field is entered by men whose education and training fit them to attack in a scientific manner their work and the principles underlying the methods of doing it.

As a consequence there has been much discussion of methods of keeping costs, of the value of the data obtained and of methods of using these data in preparing estimates of the probable cost of new work. Like all new sciences, this one has developed slowly and in the midst of much blind groping for principles and simple methods of procedure.

Evidently the keeping of the costs of a job is in itself of little value, no matter how detailed may be the classification of items. Quite as evidently a judicious grouping of items is necessary to procure results which can be used to any advantage and an intimate knowledge of conditions and methods is equally necessary for the most efficient application of the information obtained by any system of cost keeping.

The term cost-analysis has been used to denote the process of discovering what information is needed and what it means when it is obtained, and the term has been extended by some to cover the synthetic operation of applying the information as collected and analyzed to the estimation of the cost of a proposed piece of work. This use of the term is hardly scientific, however, as this process is really independent of the analysis of obtained results.

In the past the successful contractor by natural adaptation and largely unconscious cost analysis and synthesis has been able to bid with considerable intelligence and to come out on the right side of the balance sheet. Too many good men have gone down because they did not have the judgment to bid on some one contract and so could not make both ends meet.

The present, and more truly the future contractor, is applying the modern business aids to his judgment, and all contractors must come to the modern ways or vastly decrease their chances of success in their line of work.

Definition and simplification of the processes which are being tried must be the next line of advance, and MUNICIPAL ENGINEERING proposes to do what it can in this line, having in mind the benefit of the small contractor as well as of the one undertaking heavier work.

A SERIES OF ARTICLES.

We shall, therefore, beginning probably with the May number, present a series of articles covering the subjects of cost keeping, cost analysis and cost management, beginning wtih elementary principles and proceeding month by month to illustrate methods whereby the contractor may profit by a systematic organization. This work will be given a regular department in the magazine, conducted by a man who has had practical experience and who today occupies a leading position in this line of work. In addition, side lights on the questions will be submitted by others who have special qualifications.

This series of articles will be entirely practical, at the same time that they treat the subjects thoroughly. Our subscribers are invited to send us their special problems, that they may be given practical solutions directly applicable to their particular conditions.

# THE QUESTION DEPARTMENT

**Water Rates of American Cities.**

Will you kindly inform me where I can obtain a list of water rates charged in other cities. E. R., Port Huron, Mich.

The fullest list of water rates is that given in the "Manual of American Water Works" ($3) for 1897. It gives the rates charged in some 1,250 cities, large and small. Discussions of the subject, which will make it possible to study this table with understanding and further information about the rates will be found in the following recent articles in MUNICIPAL ENGINEERING:

In vol. xl: "Water Rates in Municipal Plants," p. 103; "Charges for Sprinklers and Standpipes for Fire Protection," p. 120.

In vol. xxxix: "Meter Rates for Water by Gravity System," p. 208; "Charges for Water for Laying Macadam," p. 209; "Water Rates," p. 120, in Connecticut municipalities; "Water Rates and Records at Valparaiso, Ind.," p. 18; "Information about Water Rates," p. 209. Several of these articles give references to earlier articles on the subject.

**Joining New Concrete to Old.**

Can you inform me where a preparation can be had for softening or making old work adhere to new in concrete? I have been informed that there was such a preparation called "Ransomite," but could not find anything further about it. Any information you can give will be appreciated. Thanking you in advance.
W. H. L., Sunbury, Pa.

Ransomite is one such preparation and there is also the Livingston process. Perhaps our readers can refer us to still other preparations. The Ransome Concrete Machinery Co., is at Dunellen, N. J., and J. B. Livingston is in Baltimore, Md.

**Forms for Proposals and Estimates.**

Are there in back numbers of MUNICIPAL ENGINEERING illustrations of office blanks for engineers use, such as proposal blanks and notices to contractors and monthly estimate blanks, or can you cite me to where I can procure the same?
J. W. M., Elgin, Ill.

Johnson's "Engineering Contracts and Specifications" ($3) contains forms of proposal blanks, notices to contractors, specifications, etc.

The National Paving Brick Manufacturers' Association, Board of Trade Building, Indianapolis, prepared a book of the forms required for special assessments in Illinois, which contains all the forms asked for except the monthly estimate blanks. As these forms differ in accordance with the differences in laws and customs in the various states, our correspondent should use those prepared for Illinois.

The article on "Handling Day Labor in Holyoke, Mass., in MUNICIPAL ENGINEERING, vol. xxxviii, p. 202, gives some forms for city engineer's use. In one on "Forms for Daily Force and Material Reports" on page 270 of the same volume are given some abstracts of daily reports. The article also refers to a number of earlier articles giving forms for cost keeping, field notes and office records.

Will our readers send us copies of the forms they use? They will be published either in full or by comparison with others differing but slightly from them. Please

call attention to particular provisions which have been found convenient or necessary.

**Concrete Fence Posts—Weight of Concrete.**

Will you gindly state what you think of cement fence posts? Also what does a cubic foot of concrete weigh?
J. F. E., Guide Rock, Neb.

Concrete fence posts if properly designed and made of good materials well mixed, placed and cured have some points of advantage overy any other form of post. There are now many patented and unpatented designs for posts and reinforcement and others for methods of fastening to the post, some of which are good and some are not, some practical and some not. The general opinion above expressed in favor of the concrete post should therefore not be applied indiscriminately to any particular design of post.

The weight of concrete depends upon the weight of the ingredients composing it. Taylor and Thompson's "Concrete, Plain and Reinforced" ($5) gives the following average weights for concrete of the aggregates named, respectively, when made with Portland cement: Cinder, 112 pounds; conglomerate, 150; gravel, 150; limestone, 148; sandstone, 143; trap, 155 pounds.

**Who Makes the Gisburne Ruling Pen?**

Could you let me know where I would be able to get the "Gisburne Ruling Pen? I bought some pens about fifteen years ago. About two weeks ago I tried to buy some and corresponded with different concerns but they did not know anything about the pen. W., Wausau, Wis.

Can any of our readers enlighten our correspondent?

**Books on Municipal Engineering.**

Please give me names of at least two books on municipal engineering recommending the best. F., Chicago, Ill.

McCullough's "Engineering Work in Towns and Small Cities" ($3) is an excellent practical book on the subject named in its title.

Maxwell and Brown's "Encyclopedia of Municipal and Sanitary Engineering" ($10) is a new English book which covers much of the field in encyclopedic fashion with rather brief articles upon the various subjects.

Whinery's "Municipal Public Works" ($1.65) may also be considered to be a book on municipal engineering.

The field of municipal engineering is so large that few books attempt to cover it all in any form whatsoever. Surveying, paving, sewers, sewage disposal, water supply, water purification, lighting, garbage and refuse disposal, even such detailed subjects as shade trees, have their books and only through these books can the field be covered by the student not in practice.

**Booklet on Public Service.**

Can you inform me where I can secure the leaflet "Yourself as a Public Servant" by Arthur S. Huey?
A. B. A., Decatur, Ill.

Can any of our readers answer this question?

**Cities Carrying Their Own Insurance.**

It is vitally important to me to get some information on the question as to municipalities carrying their own insurance; the idea being that their risks are scattered because of the fact that the buildings are separated from each other. If you know of any cities where it is being done or have any information, you will very much favor me by sending it to me. M. J. G., ———, Wis.

Can our readers give any information on this subject? The writer knows of no cities that carry their own insurance. Most of those of which he knows anything carry quite a full line on all public buildings.

**Public Lavatory for Cold Climate.**

Could you furnish me with some information as to the best form of public lavatory for cold winter climates such as ours, or give me the addresses to which I could apply for plans or blue prints showing the best and most modern methods of dealing with this difficulty?

Any information you can furnish will be gratefully apreciated.
T. H. W., Edmonton, Alberta.

It is necessary to heat a public lavatory used in the winter time anywhere in the United States and Canada, except perhaps in the territory bordering on the Gulf of Mexico and the Mexican line. Several articles describing public comfort stations, which include lavatories, have been published in MUNICIPAL ENGINEERING. Probably the whole of the comfort station is desired. The following are recent articles:

In vol. xl: "Appliances for Public Comfort Stations," p. 130; Public Comfort Station at Seattle, Wash.," p. 184.

In vol. xxxix: "Two Public Comfort Stations," p. 452, describing in considerable detail the stations in Indianapolis, Ind., and Brookline, Mass., including methods of heating.

**Methods and Tools for Sewer Cleaning.**

I wish to obtain some information on sewer-cleaning-methods, tools, cost, etc. Will you kindly give me a list of articles in MUNICIPAL ENGINEERING on this subject, or any other reliable source of information?
E. R. W., Port Huron, Mich.

In vol. xl, p. 218, will be found a list of articles on "Flushing Street Sewers." A list of articles on "Methods of Cleaning Sewers" others than by flushing will be found in vol. xxvii, p. 440. Since the last list mentioned was published the following articles not included in the first list have appeared:

In vol. xl: "An Interesting Test of a

Sewer Cleaner," p. 69; "The Shannon Sewer Cleaner," p. 153; "A New Sewer Cleaning Device," p. 373; "The G-K Sewer Pipe Inspector," p. 486.

In vol. xxxviii: "Cost of Sewer Cleaning in New York City," p. 287; "Cost of Sewer Construction and Cleaning in Boston, p. 347; "The Shannon Sewer Cleaner," p. 440.

In vol. xxxvii: "Results of Cleaning Water Mains," p. 111; "Makers of Sewer Rods," p. 180.

In vol. xxxvi: "Ordinance Controlling Tree Location and Roots in Sewers," p. 236.

In vol. xxxiv: "A Unique Sewer Cleaner," p. 171; "Roots in Sewer Pipe," p. 239; "Security Sewer Rods," p. 317.

In vol. xxxiii: "Cleaning Water Mains," p. 39; "Sewer Cleaning Machinery," p. 249.

In vol. xxxi: "Makers of Sewer Cleaning Tools," p. 180.

In vol. xxx: "Cost of Cleaning a Large Brick Sewer," p. 287; "Sea Water for Flushing Sewers," p. 292.

In vol. xxviii: "Tools for Cleaning Sewers," p. 96.

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**Specifications for Street Cleaning.**

I would be pleased if you can refer me to where I may obtain specifications governing contracts for cleaning paved streets.

W. H. R., Columbus, Ind.

It has usually been considered difficult, if not impossible, to write specifications which would properly govern contracts for cleaning paved streets and at the same time keep the cost down to a reasonable figure. Therefore, aside from prescribing the machinery to be used, the times the pavements are to be cleaned, and such general matters, the specifications have simply prescribed that the result shall be satisfactory to the proper city official in charge of the work. Most cities have taken up the work by their own forces that they may have full control of the results, both as to quality of work and cost of doing it.

Some years ago the city of San Francisco adopted elaborate specifications for hand and machine cleaning, which resulted in prices much higher than other cities were paying, presumably for the same work. A brief abstract of the requirements of these specifications will be found in MUNICIPAL ENGINEERING, vol. xx, p. 74, and fuller abstract will be printed if desired.

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**How to Find House Connections in Sewers.**

Do you now of any apparatus on the market for locating T or Y branches in old sewers? I find in Summit, and I imagine it is so in nearly every town where sewers have been laid, that the location of T's put in for proposed future connections are in a great many cases incorrect, and it entails considerable expense, particularly in very deep ones, to attempt to find them by digging down.

I have in a number of instances where T's were not found after digging for them, made hub connections, but this is of course not as satisfactory as connecting to T or Y branches.

J. S. S., Summit, N. J.

Can our readers make any suggestions on this line?

It ought to be possible to locate most connections by means of the sewer pipe inspector described and illustrated in MUNICIPAL ENGINEERING, vol. xxxix, p. 486, which piece of apparatus was invented by a former employe of the city of Summit. Not all connections could be caught by this instrument, but if there are any records of connections whatever it may be possible to find one by locating a connection in its vicinity and then measuring the recorded distance between them.

A method of making a new connection with a pipe sewer by removing a length of pipe from the sewer, usually by breaking it in pieces, and then inserting a new length of pipe with a Y-branch on it, is described in MUNICIPAL ENGINEERING, vol. xxii, p. 302. Parts of the bells must be cut away, to let the new length in, and these parts must be supplied by means of a carefully made cement joint.

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**Effect of Sweeping on Macadam Streets.**

I notice an article in the January number of MUNICIPAL ENGINEERING describing the injury caused to macadam roads by the use of high-speed automobiles, as they dispose of the binding material from the surface and cause the road to crumble. Would the constant use of a street sweeper injure a stone road in the same way?

Our town authorities are considering the advisability of purchasing a street sweeper. Would this treatment shorten the life of a macadam road, and to what extent?

Is it customary to sweep such roads, and to what extent is the practice followed?

W. L. BISHOP,
Supt. of Streets and Water Works,
Dartmouth, N. S.

Customs vary in this regard. Such cities as New York and St. Louis clean only paved streets, while Denver sweeps its macadam streets as well as those having harder pavements. Many small cities clean their macadam and gravel streets with hoe or scraper.

The harder surfaced macadam streets will stand sweeping very well indeed, provided it is not too strenuous, and the roadway has been well designed and constructed. With automobile traffic the conditions are very different, and it is found to be necessary to bind the particles of stone more closely together by the use of bituminous material, ranging from oil to asphalt according to the amount and kind of traffic. These bituminized roads may be swept carefully.

Will our readers report their practice and experience?

### Gas Processes and Rates.

(Continued from page 220.)

| City and Process. | Coal cost per ton. | Oil cost per gal. | Prices for Gas. Light. Gross. | Light. Net. | Fuel. Gross. | Fuel. Net. |
|---|---|---|---|---|---|---|
| OHIO—Continued. | | | | | | |
| Oberlin, coal | 2.50 | .... | 1.10 | 1.00 | 1.10 | 1.00 |
| Painesville, coal | 2.25 | .... | .... | 1.00 | .... | 1.00 |
| Ravenna, coal | 2.25 | .... | .... | 1.00 | .... | 1.00 |
| Troy, coal | .... | .... | .... | 1.50 | .... | .... |
| Urbana, coal | .... | .... | 1.50 | .... | .... | .... |
| Van Wert, Lowe | 6.50 | 2.63 | 1.50 | 1.30 | 1.20 | 1.00 |
| Washington, coal | 2.50 | .... | 1.10 | 1.00 | 1.10 | 1.00 |
| Wilmington, coal | .... | .... | 1.50 | 1.40 | 1.10 | 1.00 |
| Wooster, coal | .... | .... | .... | 0.40 | .... | 0.40 |
| OKLAHOMA. | | | | | | |
| El Reno, coal | 4.40 | .... | 1.50 | 1.45 | 1.50 | 1.00 |
| OREGON. | | | | | | |
| Baker City, coal | .... | .... | .... | 2.50 | .... | 2.00 |
| Marshfield, crude oil | .... | .... | .... | 1.75 | .... | 1.75 |
| PENNSYLVANIA. | | | | | | |
| Ashland, Lowe | .... | 4 | 2.00 | 1.80 | 1.60 | 1.60 |
| Bangor, Lowe | .... | .... | 1.60 | 1.50 | 1.60 | 1.50 |
| Bloomsburg, coal | 3.40 | .... | .... | 1.75 | .... | 1.25 |
| Bristol, coal | .... | .... | .... | 1.50 | .... | 1.50 |
| Carlisle, Lowe | .... | 3.875 | 1.50 | .... | 0.90 | .... |
| Clearfield, coal | 1.45 | .... | 1.40 | 1.33 | .... | .... |
| Conshohocken, Lowe | .... | .... | .... | 1.80 | .... | 1.25 |
| Danville, coal | 3.20 | .... | 1.75 | 1.31 | 1.25 | 0.94 |
| Gettysburg, carburetted water | .... | 3.25 | 1.65 | 1.57 | 1.25 | 1.25 |
| Hanover, Lowe | .... | .... | 1.50 | 1.40 | 1.50 | 1.40 |
| Honesdale, Lowe | 4.25 | 4.1 | 2.00 | 2.00 | 1.50 | 1.50 |
| Huntingdon, Phœnix | .... | .... | 1.50 | 1.40 | 1.50 | 1.40 |
| Jersey Shore, Lowe | 4.50 | 3 | 1.60 | 1.50 | 1.35 | 1.25 |
| Lewistown, Lowe | 4.65 | 3.125 | 1.60 | 1.50 | 1.25 | 1.25 |
| Lititz, Lowe | .... | 3.125 | .... | 1.50 | .... | 1.50 |
| Lock Haven, coal | 2.75 | .... | 1.90 | 1.50 | .... | 1.50 |
| Mauch Chunk, Lowe | 4.00 | 3.5 | 1.70 | 1.50 | .... | .... |
| Meadville, McKay-Critchlow | .... | .... | 1.00 | 0.90 | .... | .... |
| Mechanicsburg, Lowe | 4.95 | 3 | 1.50 | .... | 1.20 | .... |
| Milton, coal | 3.15 | .... | 1.50 | 1.25 | 1.50 | 1.25 |
| Schuylki'l Haven, Lowe | .... | .... | 1.50 | 1.50 | 1.25 | 1.25 |
| Slatington, Lowe | .... | .... | 1.60 | 1.50 | 1.60 | 1.50 |
| Stroudsburg, Lowe | .... | 3.15 | 1.60 | 1.50 | 1.30 | 1.20 |
| Tamaqua, Lowe | .... | .... | .... | 1.50 | .... | 1.50 |
| Towanda, coal | .... | .... | 2.00 | 1.50 | .... | 1.50 |
| Tyrone, coal | .... | .... | 1.60 | 1.50 | 1.60 | 1.40 |
| Waynesboro, Lowe | .... | .... | 1.50 | 1.25 | 1.50 | 1.25 |
| RHODE ISLAND. | | | | | | |
| Bristol, Lowe | .... | .... | 1 60 | 1.50 | 1.60 | 1.50 |
| SOUTH DAKOTA. | | | | | | |
| Aberdeen, Lowe | 7.20‡ | 4.25 | 1.85 | 1.70 | 1.85 | 1.70 |
| Huron, Lowe | 7.20‡ | 4.5 | 1.85 | 1.75 | 1.85 | 1.75 |
| Mitchell, Lowe | 7.50‡ | 4.8 | 1.75 | 1.65 | 1.75 | 1.65 |
| Rapid City, coal | 6.00 | .... | 2.00 | 1.70 | .... | .... |
| Watertown, Tenney | .... | .... | .... | 1.65 | .... | 1.50 |
| TEXAS. | | | | | | |
| Gainesville, Lowe | 7.00‡ | 4 | 1.60 | 1.50 | 1.60 | 1.50 |
| VERMONT. | | | | | | |
| Bennington, Lowe-Sutherland | 5.55 | 3.25 | 1.90 | 1.75 | 1.90 | 1.75 |
| Brattleboro, Lowe | 4.35 | 3.5 | 1.60 | 1.54 | 1.60 | 1.54 |
| Montpelier, coal | 5.20 | .... | 2.00 | 1.60 | 2.00 | 1.10 |
| St. Albans, Lowe | 7.10 | 4.1 | 2.10 | 2.00 | 1.60 | 1.50 |
| St. Johnsbury, Lowe | 6.75 | 3.3 | 1.75 | to | | 1.40 |
| VIRGINIA. | | | | | | |
| *Charlottesville, coal | 3.50 | .... | 1.25 | 1.13 | 1.25 | 1.13 |
| *Fredericksburg, coal | 2.82 | .... | 1.25 | 1.00 | 1.25 | 1.00 |
| Suffolk, Lowe | 4.20 | 3.86 | 1.50 | 1.30 | 1.50 | 1.30 |
| Winchester, coal | .... | .... | .... | 1.50 | .... | 1.50 |
| WASHINGTON. | | | | | | |
| Port Townsend, coal | 5.00 | .... | 3.00 | 2.70 | .... | 2.50 |
| North Yakima, coal | .... | .... | 1.75 | 1.50 | 1.75 | 1.50 |

| City and Process. | Coal cost per ton. | Oil cost per gal. | Prices for Gas. Light. Gross. | Light. Net. | Fuel. Gross. | Fuel. Net. |
|---|---|---|---|---|---|---|
| WISCONSIN. | | | | | | |
| Antigo, Lowe | 6.75‡ | 4 | 1.60 | 1.50 | 1.60 | 1.50 |
| Baraboo, coal | 4.80 | .... | 1.75 | 1.50 | 1.50 | 1.25 |
| Beaver Dam, Pettegrew | 5.25 | 3.24 | 1.50 | 1.30 | .... | .... |
| Berlin, coal | 4.15 | .... | 2.00 | 1.75 | 1.50 | 1.25 |
| Chippewa Falls, Springer | .... | .... | .... | 1.50 | .... | 1.35 |
| Menomonee, Pettegrew, water | 6.40 | 3.451 | 1.65 | 1.50 | 1.65 | 1.10 |
| Merrill, Lowe | .... | .... | 1.50 | 1.40 | 1.50 | 1.40 |
| Monroe, Lowe | .... | 2.96 | 1.50 | 1.40 | 1.50 | 1.40 |
| Platteville, coal | .... | .... | 1.75 | 1.65 | .... | .... |
| Portage, coal | .... | .... | .... | 1.30 | .... | 1.30 |
| Rhinelander, Lowe | .... | .... | 1.50 | 1.35 | .... | .... |
| Stevens Point, coal and Sutherland | .... | .... | 2.00 | 1.75 | 1.50 | 1.25 |
| Stoughton, Lowe | 5.65 | 3 | 1.35 | 1.25 | 1.35 | 1.25 |
| Watertown, coal | 4.10 | .... | 1.60 | 1.60 | 1.60 | 1.25 |
| Waukesha, coal | .... | .... | 1.30 | 1.20 | 1.20 | 1.20 |

Coal gas is popular in Alabama, Arkansas, Georgia, Idaho, Illinois, Indiana, Kansas, Kentucky, Maine, Michigan, Mississippi, New Jersey, New York, Ohio, Oklahoma, Virginia, Washington; less so in Colorado, Massachusetts, Missouri and Pennsylvania, with a few plants in Iowa, Maryland, Minnesota, Nebraska, New Hampshire, North Carolina, Oregon, South Dakota, Vermont and Wisconsin.

Water or oil gas is most popular in Arizona, California, Connecticut, Florida, Iowa, Louisiana, Maryland, Minnesota, Nebraska, New Hampshire, North Dakota, Pennsylvania, Rhode Island, South Dakota, Texas, Vermont, Wisconsin, with a few plants in Colorado, Illinois, Indiana, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Oregon, Virginia.

There are but few combination coal and water gas plants in cities of this size, one in Florida, two in Indiana, five in Michigan, one in New Jersey, two in New York and one in Wisconsin.

There are 133 coal gas plants, 147 water or oil gas plants and 12 combination plants among the 292 plants in the list.

The standard net price for gas for lighting seems to be $1.50 per 1,000 cubic feet. There are 85 plants having this rate, 87 having higher rates and 120 having lower rates, so that the average rate is probably less than $1.50. The extremes are Amherst, Mass., with $4, and Stoughton, Wis., with $4.95, the former having some 60-candle power; and Wooster, O., with 40 cents, possibly mixing coal gas with natural gas.

The states of Illinois, Indiana, Kentucky, Michigan, Ohio and Virginia have exceptionally low rates, nearly all below $1.50. Of the 76 plants in these states, 25 have a rate of $1.25, 25 have rates above $1.25, all but two or three being less than $1.50, and 26 have rates less than $1.25, quite a number being as low as $1.

Colorado rates are all about $1.50, whether water or coal gas. Connecticut, Florida, Kansas, Maine, Massachusetts, Minnesota, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, Vermont, Washington, Wisconsin, have consistently high rates, not far from $1.50, with very few in three or four of the larger states running below $1.25.

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### Regulations for Collecting Garbage at Householders' Expense.

Do you know of an ordinance covering collection of garbage, wherein the city imposes a tax upon the resident? It seems to me that that would be the means to a satisfactory adjustment of a difficulty which confronts us, for under the present system we have nothing but trials and tribulations, due very much to the inclination on the part of the garbage collector to take advantage of the people, as well as a natural inclination of the individuals who hide the garbage rather than have it hauled away.

DANIEL REAMER, Burgess,
Monessen, Pa.

The most satisfactory method of collection of garbage and refuse is by the city, either by city wagons or by contractors, in either case under complete control of the sanitary authorities of the city. The article in MUNICIPAL ENGINEERING on "Garbage Collection and Disposal in Minneapolis, Minn.," vol. xxxix, p. 275, and that on "City Refuse Collection," on p. 286, will give many valuable pointers. The cost of the work may be met by drafts on the general fund, by assessments upon the property or by assessments upon the people directly served, the method to be chosen according to the legal limitations, the difficulties of collection, tax limitations, etc.

Where the collection of garbage is let by contract, the contractor to collect his pay from the citizens served, there is always much trouble, and the sanitary officer of the city must be given full authority to fine those who fail to have their garbage removed under the regulations, or, in other words, fail to pay the contractor for doing his work. The contractor's wagons must also be placed under the close supervision of the sanitary officer, and this supervision must be even closer than it would be under a contract paid out of the city treasury. Some of the suggestions in the article on "Night Soil Removal," in vol. xxxviii, p. 37, will be available in preparing the ordinance.

The Chicago ordinance governing the condition and operation of wagons for collection of garbage and refuse is given in vol. xxx, p. 34. A report on systems of garbage collection and disposal, made with reference to St. Louis conditions, will be found in vol. xxviii, p. 393. There are many other articles in these and other volumes, but these apply most directly to the formation of an ordinance governing collection.

Bay City, Mich., has the most complete ordinance governing the collection of garbage by scavengers licensed by the city and paid by the citizens served. It was passed June 25, 1906, and reads as follows:

An Ordinance Relative to the Removal of Garbage.

It is hereby ordained by the common council of Bay City:

Sec. 1. That it is hereby made the duty of the occupant or occupants of every dwelling house or other building of any kind in the city of Bay City to provide a suitable tight box or other receptacle, with a closely fitting cover therefor, in which such occupant or occupants shall cause to be placed or deposited all the offal, garbage and kitchen refuse accumulating in or upon such premises; such occupant or occupants shall also cause the contents of such boxes or receptacles to be taken therefrom at least twice in each week from May 1 to November 1, and at least once in each week from November 1 to May 1 in each year, and deposited in some place without the limits of Bay City or otherwise disposed of, as shall be directed by the common council: Provided, however, That such garbage and offal may be burned or incinerated upon the premises by permission of and under the direction of the health officer of Bay City.

Sec. 2. It is hereby made the duty of the city recorder, as soon as convenient after the adoption of this ordinance, and on the second Monday in April of each year hereafter, to advertise for and receive propositions from responsible persons to collect, carry away and dispose of, as herein provided, the garbage and kitchen refuse referred to in Sec. 1, for a period of one year from and after May 1; said bids to be based upon the price per can per week, separate propositions to be made for hotels and dwelling houses.

Sec. 3. If the proposition of the lowest responsible bidder, in the opinion of the common council, is reasonable, said common council may then instruct and authorize the city recorder to issue a license to such person making such proposition, granting him the privilege to collect and receive such garbage and kitchen refuse and at the price named in his offer or proposal, the same to be collected from the individual, owner or occupant so served by such person, same to be full compensation for the services so rendered and contemplated by the provisions of this ordinance. In doing such work said licensees shall remove all the garbage offered for removal in any and all parts of the city twice each week from May 1 to November 1, and once each week from November 1 to May 1 of each year, as hereinbefore set forth, and shall also comply with the provisions and requirements of all the ordinances of the city, and particularly the ordinances relative to nuisances, public health and the use and protection of streets, alleys and public places; and shall be required to give a bond to the city in the sum of $1,000 to guarantee the faithful performance of said work and in the manner provided by law; said bond to be approved by the city comptroller: Provided, further, That in case any person fails or neglects to pay on demand for such services so rendered as aforesaid, said licensee shall promptly report same to the health officer of Bay City, and shall not be required to remove any more garbage or kitchen refuse for such person or delinquent until full payment is made for services rendered and unpaid for.

Sec. 4. Any person failing or neglecting to comply with any of the provisions of this ordinance shall be punished by a fine of not exceeding $50 and the costs of prosecution, and by imprisonment in the county jail for a period not exceeding thirty days, or by either, in the discretion of the court, and where only a fine and costs are imposed, the court may make a further sentence that the offender be imprisoned in the Bay county jail until the payment of such fine and costs, provided such imprisonment shall not exceed three months.

Sec. 5. All ordinances or parts of ordinances applicable to the whole or any portion of Bay City in any wise contravening the provisions of this ordinance are hereby repealed.

Following are some suggestions from the ordinances in other cities covering points not completely covered above:

Duluth, Minn., has a section in its ordinance providing that "the owner or agent of all buildings occupied by more than one tenant, and all flats and rows of connected houses, shall be held responsible for the permitting or suffering of any accumulation of garbage, etc., mentioned in the first section of this ordinance, and for the removal thereof. Provided, however, that nothing herein shall in any manner relieve any person who has actually caused the accumulation of such garbage, etc., upon said premises from liability for violation of this ordinance and punishment thereunder, as well as from the payment of the expenses of the removal of the same, as provided herein;" also one stating that "the common council of the city of Duluth may direct the manner in which the expense of removal of said accumulation of garbage, etc., incurred by the board of health, shall be collected; either by action, or the said common council may assess and levy a special assessment on the real estate from which the same shall have been removed by said board of health, and the said common council may so assess and levy said special assessment on said real estate in like manner provided for special assessments for building sidewalks." Probably it would be necessary in most states for the sums to be collected to accrue before assessments could be made to collect them from the property. The service is rendered to the residents rather than to the property owners, so that if collection for the service is to be made from any one it should be made, as provided in the Bay City ordinance, from the householder, rather than the owner.

Grand Rapids, Mich., has a brief ordinance placing the garbage collection under the board of health, which shall prescribe rules and regulations; defining garbage; prescribing conditions of wagons and cans, location thereof, etc.; authorizing board to contract for garbage removal and to license such scavengers; and providing that "the scavenger thus licensed shall receive no compensation from the city of Grand Rapids, but shall be permitted to make such arrangements with the citizens in the various districts that may be established by the said board of health, at a compensation not to exceed 25 cents a month for each householder, and not more than $1 a week for each hotel, restaurant or boarding house."

Omaha, Neb., has a schedule of fees for removal of garbage and dead animals, as follows: Animal over 500 pounds, $2, under 500 pounds, $1; dog, 75 cents; cat, 25 cents; load of manure, ashes or refuse, 50 cents, standard load being 64 cubic feet of manure and 27 cubic feet of ashes and other solid refuse; barrel of garbage or refuse matter of 30 gallons or more capacity, 20 cents; barrels, boxes or other receptacles of less than 30 gallons, 10 cents; night soil accessible by teams, 10 cents a cubic foot.

Salt Lake City, Utah, has the following schedule of fees: Manure, 2 cubic yards, 75 cents; barrel of refuse, not more than 30 gallons, 25 cents; smaller vessels, 15 cents for each 10 gallons; ashes, 75 cents per load; refuse, 75 cents per load; less quantities than one load, 10 cents per bushel.

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**Information About Garbage Plants.**

Please send me information for garbage plant for small town, and where I can get Morse's "Collection and Disposal of Municipal Waste."

J. R. S. Monongahela, Pa.

MUNICIPAL ENGINEERING is preparing some information about garbage plants for small cities and towns for early publication. Meantime, information about such plants, some in operation and some in prospect, can be obtained from the firms listed in MUNICIPAL ENGINEERING in the "Business Directory," published each month, under the heading "Garbage Disposal Plants."

Morse's "Collection and Disposal of Municipal Waste" will be sent by MUNICIPAL ENGINEERING COMPANY on receipt of the price, $5.

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**Portable Plants for Asphalt Repairs.**

This city has a number of old streets paved with sheet asphalt that are constantly having holes worn through the wearing surface, particularly along the street car tracks, and it is our desire to purchase some suitable portable asphalt mixing plant to make the necessary repairs.

Next to the street car tracks worn places six or eight inches in width and from one to six feet long frequently occur, while the worn places on the roadway between the tracks and gutters are usually circular in shape, one foot in diameter and larger, depending upon the length of time allowed to elapse before repair is made.

It has been the custom heretofore to have this work done by a local paving company, who, as a rule, would first clean out all rubbish from the worn places and trim up the edges of the wearing surface surrounding the wornout places in the pavement and later on deposit the wearing surface material in these holes and compress it more or less by light rolling. It is hardly ever practicable to protect these patches from traffic after they have been put in, consequently they often become more or less marked by the wheels of vehicles before the material has become hard set.

This is not the chief source of trouble, however; but because of the fact that the wearing surface material is hauled on to the streets in wagon load lots of perhaps two cubic yards, and although some attempt is made to prevent cooling by keeping a canvas spread over the load, the amount of material in one load being sufficient to fill a number of patches on the street, considerable time elapses before the whole amount is used, and often times when the last of the load is being deposited on the street it has thoroughly cooled off and the material is hard and tough and not of the proper consistency to be made to unite with the edges of the old wearing surface or with the concrete foundation of the pavement on which it rests. Nor is it possible with the material cooled off to this extent to give it the proper amount of compression, even by heavy rolling, to resist ordinary wear of vehicles. Our experience has been that these patches soon wear out and require repatching in a very short time thereafter, especially in rainy weather.

We feel that our troubles could be greatly overcome by the use of a small portable plant, one that could be operated upon the street in such a way that the material could be gotten out in small quantities and delivered for use upon the street at the desired temperature. If such a plant is not available on the market, perhaps some suitable portable heating device that would prevent the material from cooling off as it is being used could be made use of to obtain the desired results, the idea being, in the latter case, that the material should first be mixed in the ordinary asphalt plant and hauled to the heater adjacent to the work.

If your information bureau can advise us as to where such a plant can be procured or what other plant may be adopted to meet our difficulties, we will be greatly obliged.

R., City Engineer, ———, Cal.

Names of manufacturers of such plants will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the heading "Asphalt Machinery," "Asphalt Plants," "Portable Paving Plants. Descriptions of the work done by such plants and some figures of the cost will be found in the following articles in MUNICIPAL ENGINEERING:

In vol. xl: "The Municipal Asphalt Paving Plant at Detroit, Mich," which is a municipal plant, but is not a portable plant.

In vol. xxxix: "The Goodwin Portable Asphalt Plant," p. 60; "Denver's Municipal

pal Asphalt Plant," p. 138, a municipal plant, not portable; "Cost of Maintaining Asphalt Streets in Brooklyn," p. 314, with a municipal plant, not portable; "A Portable Asphalt Plant," p. 410, describing the Link-Belt Company's plant used on the street; "Capacity of Link-Belt Company's Portable Asphalt Plant," p. 489.

In vol. xxxviii: "Atlas Dryers and Portable Asphalt Plant," p. 60, a one-car plant; "Report of the Indianapolis Municipal Asphalt Repair Plant for 1909," p. 116, a municipal plant, but not portable; "Asphalt Repairs in Marion, Ind., in 1909," p. 197, made with a Hooke portable heater; "Cost of Operating San Francisco's Asphalt Plant," p. 201, a municipal plant, not portable; "The Cummer Portable Asphalt Paving Plant," p. 215, a one-car plant; "A Portable Atlas Dryer," p. 280, for use on streets; "Bitu-Mass for Roadways," p. 360, using a portable plant on the street; "Cost of Asphalt Repairs in Brooklyn," p. 428, a municipal plant, not portable; "Dryer and Heater for Broken Stone, Grit, Sand and Gravel," p. 438, a portable machine for use on the street.

In vol. xxxvii: "Asphalt Repairs for a Small City," p. 36, giving also some references to earlier articles on the subject; "Cost of Asphalt Repairs in Syracuse, N. Y.," p. 38.

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**Concrete Foundation Under Steam Railway Tracks in City Street.**

This city contemplates repaving one of its principal business streets. In this street there is located a steam railway. I have insisted that the railway company place its tracks on a concrete foundation. The railway company does not object to this, but they doubt the success of this method of construction and have asked that I point out to them some place where a concrete foundation is placed underneath the ties and rails of a steam railway. I would greatly appreciate it if you can advise me where there is a steam railway track placed on a concrete foundation.

S., City Engineer, ———, Va.

Such foundations are very common under street and interurban railway tracks but are very uncommon under steam railroad tracks. The only one known to the writer is one under an industrial railway track with comparatively light loads, not much greater than those of the heavy interurban cars. This railway is described in MUNICIPAL ENGINEERING, vol. xxxii, p. 38, and vol. xxxiv, p. 40. The inventor recommends this construction for steam passenger railroads, but it has not been used as yet under their rails. The shocks to the foundations are so much more severe in a steam railroad that much heavier concrete construction would be required for permanence than under a street railway.

Can our readers give information about concrete foundations under steam railroad tracks?

**Water Required for Laying Concrete Walks.**

Can you inform me approximately the amount of water necessary per cubic yard for making concrete sidewalks where one part cement, three parts sand and four parts gravel are used. This information is desired as the water department is trying to find out how to charge them for water.

J. H. T., Arkansas City, Kan.

In MUNICIPAL ENGINEERING, vol. xx, p. 214, it is stated that a square yard of cement walk 4 inches thick, including amount necessary for wetting stone, may easily require 30 gallons, allowing a little for excess of moisture. Water used in moistening foundation for tamping or rolling must be added, also waste and water used for washing and cleaning boards, tools, etc. At the same rate, a cubic yard of sidewalk material would require some 270 gallons of water, or say 300 gallons with the allowance for waste. There may be considerable variation from this estimate in any particular case, owing to conditions of moisture of atmosphere and materials, rate of evaporation, specifications, rate at which work is done, etc. Can any of our readers give results of measurements taken in the regular course of construction?

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**Who Should Pay for Changes in Water Connections Due to Street Paving.**

The water company had to lengthen a number of service pipes on West Second street, because the council wanted the street widened when bricks were adopted for paving, and the pavements were made narrower to the same extent as the street was widened. When the water company did put in all these services, the law was obeyed, and each stopbox was put one foot inside of curb, company receiving only $5.00 for each service, no matter if it was 40 feet long or only a few feet. This price has been a hardship on water company and now the council widening the street, makes another expense to solder on a few feet of pipe, etc., for which I believe the city ought to pay.

The water company set a number of fire hydrants, according to stakes driven by council committee. Changes in width and elevation of street made it necessary to move a number of hydrants, and I say the city should pay for all such changes. A. S., Superintendent.

This is a question which can be answered only after a study of the provisions of the contract between the water company and the city and of the other local conditions. It is quite common to require in franchises that all such changes as those mentioned shall be made by the water company upon due notice without expense to the city. Service pipes under some franchises are paid for by the property owners and in such cases the practice may be different regarding them.

The privilege of doing business in the city streets is worth something, and the burden which the water company's use of them places upon them must be made as light as possible. Therefore, the decision, in case the matter is not mentioned

in the franchise or contract, is likely to be the same as that given above. However, if the water company has made concessions in the form of free water to the city or low hydrant rentals or low rates to consumers, equity may require that the city or property holders should pay the expense of the changes described. In the absence of full knowledge regarding all these conditions a just decision could not be rendered.

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**Bitu-Mass for Roads and Pavements.**

The Bitu-mass pavement is a new kind of a pavement in this section of the country, but we were informed that it was or is, to be used quite extensively in Indianapolis.

Can you give us any data on this kind of pavement as to the cost as compared to asphalt, durability, sanitation, etc., and is it giving entire satisfaction?

How long has the pavement been laid in your city and in what kind of a condition is it at the present time?

R., Walla Walla, Wash.

I would like some information about Bitu-mass, which has been laid in Indianapolis, as to

1. Present condition of these streets in Indianapolis with reference to age and amount of wear, travel, etc.
2. Resistance to heat.
3. Dustlessness.
4. Foothold for horses and its favor with motorists.
5. Actual cost of maintenance, repair, etc.
6. Does the general public favor it?

B., Spokane, Wash.

A similar request has been received from Olympia, Wash.

The first three Bitu-mass streets were laid in Indianapolis in 1909. The first was laid with too much bitumen, and not enough gritty material and has been too soft for any considerable travel. The second street was an improvement over the first and the third street, laid late in the fall of the same year, was better laid in both respects and is in excellent condition. Two streets laid in 1910 are also in good condition. One street begun in 1910 has not yet been completed. Travel over the first two streets is rather heavy, especially over the first one laid, as the cross-town travel of a considerable residence district strikes it. The other streets have the ordinary travel of residence streets, which are not thoroughfares of through traffic. The streets, except the first two mentioned, show no appreciable wear.

2. The pavement is in effect a bituminous concrete, and has the general characteristics of such material. The writer has not observed it in very hot weather, but his observation of both the streets in which too much bitumen was used and those in which the materials were properly proportioned, indicates that it will withstand successfully the temperature conditions of this country.

3. The aggregate is held in place by the bitumen so that the formation of dust from the aggregate is reduced to a minimum.

4. The surface shows the mineral particles and is, therefore, not slippery. It should be entirely satisfactory both to horsemen and motorists.

5. Pavements with proper proportions are not yet old enough to show need for repairs. The cost of maintenance should not be greater than that of other bituminous pavements of equally high grade. The latest street built was petitioned for by nearly all the property owners on the street, and they are reported to be well pleased with the result.

7. The cost is materially less than that of asphalt pavement. It compares favorably with that of other bituminous macadams of like grade.

# FROM WORKERS IN THE FIELD

**Practical Points from Practical People.**

**Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.**

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**Water-Tight Sewer Joints at Harrisburg, Va.**

To the Editor of MUNICIPAL ENGINEERING.

Sir—We have just finished laying two miles of 8-in. sewer pipe at a cost of $5,000.00. Six hundred feet of this was laid through a swamp through the race track grounds, in which I used G-K sewer joint compound. I found it an excellent material and feel that there can be nothing better to make a good sanitary and water tight joint. After draining the grounds the sewer was put through three feet deep. This will be submerged and made a lake again. The infiltration of water was practically nothing through 600 feet. I am sending you picture of laying the pipe.

J. F. NOLL, Superintendent Public Works,
Harrisburg, Va.

### What Happened to Smith.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Bill Smith, the engineer of a small town in California, was recently called upon, by the Town Board of Trustees, to prepare plans and specifications for a new water works and distributing system. Up to this time, his work had been land surveying and outside of giving a few street grades and staking out a couple of town lots, he had done little else. Bill is conscientious and well read, but, while always having been interested in municipal improvements, he was forced to realize that he was not entirely fitted to handle this job.

Smith had about made up his mind to suggest to the board that a brother engineer, who was thoroughly familiar with such work, be employed in consultation to supervise the preparation of these plans and specifications, when a contractor named Browne dropped into town. Browne makes a specialty of this kind of work and it is a part of his business to keep posted in the doings of town officials. He is generally on the job before the bids are called for and gets very well acquainted with useful members of the community. Aided by an agreeable personality, showing a generous disposition to buy more than his share of drinks and cigars, and purposely being a good loser in a game of poker, he soon gained Bill's friendship and confidence.

During a discussion of the proposed improvements, Bill Smith told Browne of his intention to ask the members of the Board for help, saying that in justice to the people of the town and to the members of the Board he should not undertake something which he could not properly finish. Browne proffered his help. He said that he knew more about this kind of work than anybody in the State; that he had put in a dozen or more works of this kind; and that he already had plans and specifications of a water works system almost identical to the one proposed. He said that Bill could have a copy of the specifications and that if there was anything which he did not understand, he (Browne) would consider it a pleasure to explain it to him. If Bill would say so, he would prepare a set of plans, estimates, etc., which Bill could turn into the Board as his own. This, Browne said, was a trifling expense to him, part of his regular overhead, and would keep some of the younger members of his office force busy and out of trouble while he was away from the office.

Browne argued that the fee of the consulting engineer was an unnecessary expense to the town and that to call for help was a bad thing for Smith to do because he was supposed to be posted on such matters. He argued further that if Smith could get along without help, it would help him politically. He would be raised in the estimation of the people of the town for having carried on such a large and creditable piece of work.

Smith was non-commital, but when a week later a neat drawing of the proposed water works and well-arranged specifications were sent to him by Browne, he decided to go at it alone. He retraced the plans and had several copies of the specifications made by the printer, who was editor and general manager of the town paper. He was congratulated by the president of the Board when he turned in his report and plans and for some time afterward was beseiged with the ingratiating attentions of numerous contractors who were to bid on the work.

When the bids were opened Browne's bid was low and considerably lower than those of the majority of bidders, who were very close together. Browne got the job. One high bidder was heard to remark that he was just as well satisfied that he did not get it because there was a good deal of uncertainty about some parts of the specifications and he had thought it necessary to protect his company by adding five per cent for emergencies.

The contract was signed up and the work started. As things progressed it was discovered that the specifications were not clear about a gas-engine foundation. A five-hundred-gallon fuel tank, though necessary, was not mentioned, nor was a roof over a settling reservoir. Later, when an old fire pump, which was to be part of the new system, was moved over into a concrete pit built to receive it, Old Zeik Edgecome, the oldest inhabitant and an authority on things generally, discovered that the pump was a foot longer than the pit. The dimensions of the pit had been shown on the plan, which Browne had followed carefully.

Browne's contract provided for extra work on a very liberal basis and he started in at once to make all the necessary alterations and additions.

When the cost of the work had run up from $16,500 to $21,400, it suddenly struck Smith that the town would have very little money left out of the sale of the bonds with which to buy water meters. Smith tried to call a halt on Browne. Browne smiled and quietly suggested that the whole matter be put up to the Board. This Smith could not afford to do because he had allowed the impression to exist that he was familiar with the work and all this was clearly his oversight, caused by inexperience. Smith waited and worried.

The job was finished and the machinery tested. The guarantee was exceeded and the Board complimented Browne upon the efficiency of the plant. This efficiency was about one hundred and ten per cent. Something that the town should be justly proud of. Browne had made a nice little

stake out of the extra work and departed to put through a job in another town.

When it was found that there was not enough money left to buy even a few meters and that a nephew of old Zeik could not be paid as driver of the new water wagon, there was on awful fuss. The people of the town accused Smith of grafting and the Town Board of Trustees criticised him severely.

Smith is honest and conscientious and had worked as hard as he knew how to make the work a success. Instead of the town's saving money, money was lost because there was no competition on this extra work, part of which was unnecessary.

Browne says that Smith is a pseudo engineer and that if it had not been for the members of the Board and himself the town would have had no water works at all. Smith was always bothering him he says.

Smith has lost his reputation in town and is hustling to keep a young college man from beating him out for the nomination for county surveyor. This young man is another relative of Old Zeik and claims that, from what he learned at college and from what the professor of physics has written him about efficiency, more than one hundred per cent is too much for a country town, and that Bill Smith ought to have known it. DIOGENES.

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**Smoke Abatement Campaign Material.**

The Smoke Abatement Compaign Association of Indianapolis has prepared the accompanying form of report for distribution among its members and others. The plan is to make such reports at reasonably regular intervals, to collect information concerning each individual offender and then take up the question of abatement in the manner best suited to the particular case. The Association has appointed three engineers to aid in this stage of the work by recommending methods of reducing smoke in particular cases. The Association is engaged at present in a special inspection campaign in one portion of the city and is collecting a large amount of data on the blanks regarding all the offenders against the smoke ordinances at this particular time.

## Smoke Abatement Association

OF INDIANAPOLIS

*Period of observation from* ..... *to* .....

*Name of property owner* .....

*Address* .....

*Point of observation* .....

*Observation began* ..... *M.*

*" ended* ..... *M.*

*" interval* ..... *Min.*

*Weather* ..... *Wind* .....

*Remarks* .....

.....

.....

*Observer* .....

*Address* .....

*Date of report* .....

| DENSE BLACK OR GRAY SMOKE | | | | |
|---|---|---|---|---|
| BEGAN | | STOPPED | | INTERVAL—MIN. |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

*Dense smoke for* ..... MIN.

*Per cent. of time dense* .....

When plant has more than one stack, indicate one observed

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**To Prevent Dusting or Easy Abrasion of Improperly Laid Concrete Floors.**

To the Editor of MUNICIPAL ENGINEERING:

Sir: Cement floors, particularly in office buildings or warehouses, which do not have the advantage of obtaining the necessary moisture from the atmosphere such as outside floors and sidewalks on which the dew falls at night, if not properly protected and kept damp, become prematurely dry and are therefore more or less porous and weak, causing easy abrasion under foot traffic, or what is commonly known as dusting.

Care should be exercised in keeping such floors damp by covering with wet sand, wet hay or straw, for a week or more until the floor has properly hardened. If this has not been done and the floors are found to dust under foot traffic, the following remedy will be found very easy to accomplish, economical and effective:

Wash the floor thoroughly with clean water, scrubbing with a stiff broom or scrubbing brush, removing all dirt and loose particles. Allow the surface to dry, as soon as dry apply a solution of one part water-glass (sodium silicate) of 40 degrees Baume, and three or four parts of water, the proportion of water depend-

ing upon the porosity of the concrete. The denser the concrete the weaker the solution required. Stir well, and apply this mixture with a brush (a large whitewash brush with long handle will be found the most economical). Do not mix a greater quantity than you can use in an hour.

If this solution is sufficiently thin, it will penetrate the pores of the concrete. Allow the concrete surface thus treated to dry. As soon as dry, wash off with clean water, using a mop. Again allow surface to dry and apply the solution as before. Allow to dry and again wash off with clean water, using a mop. As soon as the surface is again dry, apply the solution as before. If the third coat does not flush to the surface apply another coat as above.

The sodium silicate, which remains on the surface, not having come in contact with the alkalies in the concrete, is readily soluble in water and can therefore be easily washed off, thus evening up the color and texture of the floor. That which has penetrated into the pores, having come in contact with the other alkalies in the concrete, has formed into an insoluble and very hard material, hardening the surface, preventing dusting and adding materially to the wearing value of the floor.

ALBERT MOYER,
New York City.

LAYING WATER TIGHT SEWER IN SWAMP AT HARRISBURG, PA. (See page 352).

# MUNICIPAL MATTERS IN COURT

## Higher Courts—Protection of Contractors—Street Ownership—Character of Water—Purchaser Must Pay—Creosote Poisoning

**Decisions of the Higher Courts of Interest to Municipalities.**

Power of County Commissioners to Relocate an Existing Bridge—Where a river spanned by an expensive bridge cuts a new channel, through which thereafter most of the water of the stream flows, it is competent for the county commissioners to remove the bridge from its position over the old channel and to rebuild it over the new one, and an owner of land some distance from the bridge, but through whose land the highway connecting with the bridge passes, and who has full and free access to and from the land by other highways, is not entitled to an order enjoining the commissioners from removing the bridge. Anderson vs. Board of Commissioners of Cloud County et al. (Kan.). 111 P. 464.

Right to Issue Water Works Bonds—Assuming that under the statutes above described water works bonds should be included in estimating the amount of outstanding indebtedness for the purpose of ascertaining whether the statutory 5 per

cent. limit has been reached, if the city's financial condition is such that two sets of bonds, one for water works and one for a city hall, may lawfully be issued by giving the latter priority in time, both may be issued at the same time without violating the statute; and where under such circumstances city hall bonds are first voted and first authorized by ordinance, their issuance must be deemed substantially contemporaneous with that of water works bonds which bear the same date and mature at the same time, but which are actually executed a few weeks earlier. State ex rel. Taggart, County Attorney vs. Kansas City et al. (Kan.). 111 P. 494.

Injury to Pipes of Water Company by Electrolysis—In a suit by a water company against an electric street railway company to enjoin defendant from injuring the mains and service pipes of complainant by electrolysis caused by electricity generated by defendant, the evidence showed that both parties used in part the same streets under franchises granted by the city; that defendant operated its line by the single trolley system, using the rails as return conductors; that complainant's pipes were being injured by electricity which passed to them from the rails through the earth, but not to the serious extent claimed, and that the injury was being lessened by means adopted by defendant by the use of brazed rail bonds and by feeder wires from the rails to the negative side of the dynamos. The weight of the expert testimony also tended to show that, while the escape of electricity from the rails to the water pipes and consequent injury to the latter by electrolysis could not be entirely prevented in the system used by defendant, it could be so lessened by the means defendant was adopting or other means suggested and used elsewhere as to practically prevent serious injury to the pipes of complainant. *Held*, that it was the legal duty of defendant to prevent such injury by all reasonable and practical means; that it would be enjoined from continuing such injury, but would be left free to adopt within a reasonable time such means to that end as it should be advised. Peoria Water Works Co. vs. Peoria Railway Co. (Ill.). 181 F. 990.

Expenses of City Official Inspection Trips—A resolution was passed by the city council of Atlantic City to pay the expenses of that body, together with the mayor, city engineer and city solicitor, in visiting Pensacola and New Orleans to inspect drainage systems in operation in those cities, as a preliminary to the installation of one in Atlantic City; "the expenses * * * to be paid out of the funds now in the treasury belonging to the drainage system." There was no appropriation for the purpose; the only balance in the treasury belonging to the drainage system was from the proceeds of bonds issued under ordinance "for the purpose of providing moneys for the payment of contracts now made or hereafter to be made for the construction and installation * * * of a drainage canal," etc. *Held*, that the resolution was beyond the purpose specified in the ordinance and was invalid. Loudersiager vs. Atlantic City (N. J.). 77 A. 1060.

The Right to Reject the Lowest Bid—The Spokane city charter, providing that the board of public works shall reserve the right to reject any and all bids for work to be done by contract, allows the board to let the contract to the one it considers the best bidder, quality of material as well as price being considered; so that in the absence of a showing of absolute fraud or such a pecuniary loss to the city, determinable by some measurable standard, as to indicate a manifest abuse of discretion, its rejection of the lowest bid and acceptance of the higher for pumps and equipment to raise a certain quantity of water, the bidders offering machinery of different manufacture cannot be interfered with by the courts. Stern vs. City of Spokane et al. (Wash.). 111 P. 231.

Street Improvements not Public Utilities—Street improvements do not constitute "public utilities," within the meaning of the term as used in section 27, art. 10, of the Constitution, which provides that: "Any incorporated city or town in this state may, by a majority of the qualified tax paying voters of such city or town, voting at an election to be held for that purpose, be allowed to become indebted in a larger amount than that specified in section 26, for the purpose of purchasing or constructing public utilities, or for repairing the same, to be owned exclusively by such city." Dingman vs. City of Sapulpa (Okla.). 111 P. 319.

Free Service as a Consideration in a Franchise—A heating company acting under a municipal franchise granted on condition that it furnish heat for a public library building, free of charge, bringing the service to the curb, cannot escape performance because the building was not in existence, being merely contemplated, when the franchise was granted, nor because as originally erected the building was not equipped to receive the heat, nor because it is two blocks away from the mains. State ex rel. City of Marion vs. Marion Light & Heating Co. (Ind.). 92 N. E. 731.

Control of Sanitary District Annexed to Municipal Corporation—There cannot be at the same time within the same territory two distinct municipal corporations, exercising the same powers, jurisdiction and privileges. A sanitary district is extinguished and dissolved on annexation of its territory to an adjacent municipal corporation. In re Sanitary

Board of East Fruitvale Sanitary District (Cal.). 111 P. 368.

Front Foot Assessment Invalid—A special assessment for a street improvement, which is made on the basis of frontage merely, without regard to special benefits, is invalid. City of Nokomis vs. Zepp et al. (Ill.). 92 N. E. 809.

Powers of a Municipal Corporation—A municipal corporation possesses only such powers as are expressly granted, those necessary or fairly implied as incidental to the powers expressly granted, and those essential to the declared objects and purposes of the corporation, not including those merely convenient. Any fair, reasonable doubt concerning power in a municipal corporation is resolved against it. City of Chicago vs. Weber et al. (Ill.). 92 N. E. 860.

Right of Condemnation by a Public Utility Corporation—A corporation organized to furnish municipalities with electricity to light the streets and public buildings, and for other municipal purposes, may be authorized by the Legislature to condemn land necessary for the generation and transmission of electricity for such purposes, though the powers of the corporation embrace matters of private use. Deerfield River Co. vs. Wilmington Power & Paper Co. (Vt.). 77 A. 862.

Validity of Paving Assessments—A City can create a valid municipal lien for improving a street only when the improvement is made pursuant to law, and the mode established by statute is strictly followed. Where the mayor and city council fail to meet "to hear and adjust any complaint and review such assessment" at the meeting called pursuant to the notice required, such assessment is void. Morrow vs. Barber Asphalt Paving Co. et al. (Okla.). 111 P. 198.

Technicalities Invalidating a City Election—Where the last publication of the notice of a city election to adopt the commission form of government in a city of the second class was only five days before the date fixed for the election, and less than a majority of the registered voters voted upon the proposition, the commission form of government was not adopted, although a majority of the votes cast were in favor of the proposition, and although the vote was canvassed and the result declared accordingly. Rice et al. vs. Robson et al. (Kan.). 111 P. 186.

Police Powers in Preventing Smoke Nuisance—Rochester city ordinances prohibiting the emission of dark smoke from chimneys during certain hours of the day, and providing a penalty for the violation thereof, was within the city's police power. City of Rochester vs. Macauley-Fien Milling Co. (N. Y.). 92 N. E. 641.

Liability of a Subcontractor—Defendants, an owner and a principal contractor, contracted with a subcontractor to build a water tower. The subcontractor furnished the material and constructed it. *Held*, that the subcontractor, being an independent contractor, defendants could not be liable for the death of an employe resulting from the collapse of a platform on the tower, due to weakness of the supports. Kilts vs. Board of Supervisors of Kent County et al. (Mich.). 127 N. W. 821.

Condemnation of Railway Right-of-Way—Where a city had only general charter power to open, lay out, establish, widen, alter, extend, vacate or close streets, and to appropriate and condemn private property therefor, it had no power to condemn a part of a railroad's right-of-way to construct a street longitudinally along the same, especially where there was no provision for joint use of the property by the railroad company and the public. Portland Railway, Light & Power Co. vs. City of Portland et al. 181 F. 632.

Street Improvements as Trespassing—Where a city proceeds with the work of grading a street and damages property without first taking steps to ascertain and pay the damages, it is a trespasser, and those actively participating in the work by directing it are co-trespassers. Abercrombie vs. Kansas City (Mo.). 131 S. W. 129.

Unlawful Occupation of a Street by a Public Service Corporation—A railroad company cannot condemn the interest of abutters in a street where its franchise to occupy the street has been revoked for breach of a condition of the grant. Unlawful occupation of a street by a railroad constitutes a public nuisance, which may be abated by an abutting owner suffering a special injury therefrom. Sylvester et al. vs. Superior Court for Benton County (Wash.). 111 P. 19.

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**Liability for Character of Municipal Water Supply.**

In a case decided recently by the Supreme Court of Minnesota, it was held that a municipality is liable for damages suffered by citizens owing to the character of the city-supplied water.

The decision was given in the cases of Della Keever and Kate Flanagan, two Mankato women whose husbands died during the typhoid fever epidemic in that city in 1907 and who sued the city for $5,000 damages each. The lower court ruled against them and the Supreme Court reversed the case. The attorneys for the defendants said in their argument before the court last spring if it was decided that the city was liable it would mean damage suits aggregating $10,000,000 would be filed against the city. This, they said, would bankrupt the city and threaten its very existence, as the assessed valuation of property in Mankato is only $4,000,000.

The court discusses this point in the

opinion written by Justice Jaggard, but says that while the attorneys showed the far-reaching danger of such a decision, this point could not be considered, as there was nothing in the record to show that any more suits would be filed and the danger facing Mankato was not known to the court.

The decision says cities are at present held liable for neglect in connection with streets, sidewalks and sewers, and there is no more reason why they should not be held liable for neglect in furnishing water. There is no reason why a private corporation furnishing water should be liable and a public corporation doing the same business should not be liable to innocent people who may have been damaged by its neglect.

The case was remanded to the lower courts to establish whether the water supply was responsible for the deaths, and if the city was negligent in the matter of maintaining the purity of the water supply. It was stated that the typhoid epidemic had been caused by a leak from the sewer system into the water mains.

The city of Lexington, Va., has recently encountered a similar case of contamination of the water supply. A typhoid epidemic in the public schools led to the investigation of the local water supply by Richard Messer, state sanitary engineer, and Dr. A. W. Freeman, assistant health commissioner of Virginia. It was held probable from the investigation that the epidemic was due to the contamination of the water supply by the entrance of sewage into the water mains. The source of the water supply is a mountain stream entirely free from contamination. It is piped to an elevated reservoir, from which it runs to a supply basin.

During a recent water shortage, the valve at the reservoir was closed every night in order to guard against waste through leakage from the supply main, as the latter had been found to be old and in a leaky condition. It is supposed that as the water in the supply main ran down into the distributing basin, a partial vacuum was established, allowing sewage to be drawn into the mains from a sewer built directly alongside of the water main. Excavations have shown the ground adjacent to the water main to be saturated with sewage.

The typhoid epidemic has been checked and care is being taken to guard against what is considered to have been the cause.

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**For the Protection of Material Contractors.**

The state of Georgia has recently passed an act for the protection of material men who furnish supplies to contractors engaged in city or other public work. This act provides that any firm or corporation entering into a contract with the state, county or municipal authorities for any public work shall be required to execute a bond with sufficient surety, conditioned that such contractor will promptly make payment to all persons supplying labor or material for the contract. The right of action under this bond, on the part of the material men, is made one year from its date of execution.

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**Ownership of Streets.**

The Supreme Court of Illinois has made a decision regarding the power of a city council to grant space on sidewalks or streets for the display of merchandise, signs, etc. In this connection the ownership of public streets is definitely specified as follows:

The public streets of the city are dedicated to the public for public use and are subject to the control and management of the city council, but that body had no power to alienate or otherwise encumber such streets so long as they are public streets, but must hold them in trust for public use only. The municipal corporation can grant no easement or right therein not of a public nature and the entire street must be maintained for public use, hence no individual or corporation can acquire any portion of the street for exclusive or private use to the exclusion of the public.

The city council has no right to grant such use. It may grant a temporary use in such a way as not to interfere with public use, yet there is no power in the municipality to sell or grant for private use a public street and exclude the public therefrom.

A permanent encroachment upon a public street for a private use is purpresture and is in law a nuisance.

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**Liability for Creosote Poisoning.**

In the case of Pinkley v. Chicago & Eastern Illinois R. R. Co. before the Supreme Court of Illinois, the question of assessing damages for injuries received in handling creosoted ties was decided. It was held that the employer was not an insurer of the safety of his employe and the law does not impose upon him the duty of warning the employe of the danger of handling timbers treated with a coal-tar preparation containing creosote.

The court further held that if an employe knows that the handling of timbers treated with a coal-tar preparation containing creosote will produce a burning of the skin sufficient to cause it to peel off, the employer owes him no duty to warn him of such danger, and that the fact that the employe becomes permanently poisoned as a result of handling the timbers does not render the employer liable unless he knew, or in the exercise of ordinary care could have known, that such a consequence might result and failed to warn the employe.

# WATER WORKS

## Rockford, Ill.—Derwent, England—Norfolk, Va.

**The Derwent Valley, England, Water Works.**

The report of Vice Consul William Force Stead, Nottingham, England, contains an account of the Derwent Valley Water Scheme which is just being completed in the Derbyshire hills. A short abstract of this report follows:

This is the undertaking designed to supply water to the cities of Nottingham, Derby, Leicester and Sheffield and to the counties of Nottinghamshire and Derbyshire. The full scheme comprises the construction of five reservoirs for impounding the waters of the Derwent and Ashop Rivers, with about 100 miles of aqueduct for distributing the water to the various authorities, about 20 acres of filter beds at Bamford, and a general service reservoir at Ambergate. For the present, of the five reservoirs ultimately to be constructed, only two, the Howden and Derwent, are being proceeded with, and it is estimated that these two alone will provide the following daily yield, in gallons, to the following places: To Leicester, 4,018,000; Derby, 2,813,000; Sheffield, 2,813,000; Nottingham, 2,000,000; Nottingham and Derby Counties, 1,750,000.

The following table will give an idea of the scope of the plan:

| Reservoir | Water shed area | Area of reservoir when full | Capacity | Level of top water above ordnance datum | Length of reservoir | Height of dam | Length of dam |
|---|---|---|---|---|---|---|---|
| | Acres. | Acres. | Gallons. | Feet. | Miles. | Feet. | |
| Howden ..... | 9,321 | 157 | 1,940,000,000 | 870 | 1¼ | 118 | 1,070 |
| Derwent ..... | 3,899 | 183 | 2,000,000,000 | 776 | 1¾ | 114 | 1,110 |
| Hagglee ..... | 10,987 | 178 | 2,160,000,000 | 806 | 2 | 136 | 980 |
| Ashopton ..... | 1,257 | 141 | 1,472,000,000 | 675 | 2 | 103 | 840 |
| Bamford ..... | 6,482 | 242 | 2,495,000,000 | 585 | 2¼ | 95 | 1,950 |
| Total ..... | 31,946 | 901 | 10,067,000,000 | ..... | 9¼ | ..... | ..... |

No pumping stations are required, as the whole supply will be by gravitation. At the Howden Reservoir the top water level is 870 feet above sea level; at the Ambergate Service Reservoir the level is 640 feet, and the highest point near Nottingham is the Ramsdale Reservoir near Arnold, which is 500 feet above sea level, while Mapperly, the highest point to be supplied in Nottingham, is 100 feet lower.

The Howden Dam, is the farthest up and the starting point of the scheme. From the river bed to the top of the dam over which the water will flow is 118 feet; the foundation, of stone and concrete, is 68 feet deep, and below the foundation, to prevent any percolation, a cut-off wall or heel trench of solid concrete, 6 feet thick, runs down a farther depth of 60 feet. Thus the masonry from the bottom of this cut-off wall to the top of the dam represents the great height of 246 feet. The thickness at the base is 176 feet and the length 1,070 feet. The waters held by this huge structure will extend back a mile and a quarter, forming a reservoir of 1,940,000,000 gallons. Some idea of the magnitude of the whole scheme may be gained by reflecting that ultimately there are to be four other reservoirs, giving a total capacity of 10,067,000,000 gallons. At present the scene of the future lake at Howden is a pleasant valley containing pasture lands where the cattle are feeding and an old stone farmhouse. In another year or two pastures and farmhouse will be at the bottom of the lake.

It was thought at first that the hills on either side were of solid rock, and that the dam could be keyed in. Excavations, however, revealed that, owing to earth movements, the rock has become shattered, and what are known as wing walls, or wing trenches, had to be constructed to prevent a leakage through the rock. These wing walls, built of concrete, 5 feet thick, are carried up the valley from the dam a distance of 3,000 feet on both sides, varying in depth from 200 to 40 feet, and have involved an expenditure of $973,000.

From one of the two valve towers surmounting the dam the flow of the filters is regulated, and in the other are the scour-out pipes for relieving the dam of

refuse. A subway runs through the dam, connecting these two towers, and saving the long distance that would otherwise have to be covered in crossing from one side to the other.

The Derwent Dam is two miles downstream from the Howden. Its length is 1,110 feet, its height is 114 feet, the length of the reservoir it will form is one and three-quarter miles, and its capacity will be 2,000,000,000 gallons. The hills here also proved to be formed of shattered rock; but instead of wing walls running back upstream, as resorted to at Howden, a trench 6 feet broad and 200 feet deep, filled with concrete, has been continued from the ends of the dam and carried into the hills a distance of 500 feet on either side.

The filters are built on a hill above Bamford. These are for the water sent to Nottingham, Leicester, Derby, and the counties of Notinghamshire and Derbyshire, the Sheffield water being taken off in separate pipes and filtered elsewhere. The filters are divided into two sections, the fine or sand filters, and the rough or gravel filters. The Derwent, flowing through regions where peat is found, carries considerable matter in times of flood, and consequently roughing filters have to be provided. There are four of the latter, all identical, and all subdivided into four sets each, with gravel of increasing fineness. The first contains gravel of ⅝ inch size; the second, gravel of ⅜ inch; the third, ¼ inch; and the fourth, ⅛ inch. The gravel rests on perforated concrete plates. These rough filters are equipped with a compressed-air cleaning process, by means of which the accumulated debris is blown off and washed out through a channel provided for the purpose. This is a French patent, operated by a Paris company.

After the coarser particles are removed, the water is sent on to the fine filters, but when the stream is comparatively clear, the rough filters are not employed. For the present there are seven of the fine, or sand filters, covering an area of five acres. All seven are not required at a time; four or five may be serving the reservoirs while the others are being cleaned. Two feet of fine sand rest on 12 inches of gravel, and this in turn on moon-shaped tiles. The water, from a channel at the rear, is let in by valves to a trough, over the top of which it ebbs gently on to the sand. When the sand requires cleaning, 1 inch of the surface is removed, and the edge of the trough being lowered the same amount, the ebb is maintained without a fall. From the filters the water passes out through a valve house, where an automatic recorder takes account of the amount filtered, the estimated capacity being 10,000,000 gallons per day.

Thence the supply is sent to the general service reservoir at Ambergate, 24 miles below. On its way to this the water is carried through a 45-inch pipe, with an average fall of 3½ feet per mile; a culvert is employed on a level, and tunnels at hills where it is found cheaper to go through than around. The culverts and tunnels fall 1 foot in 4,000 feet. Culverts and tunnels alike are 6 feet 3 inches in diameter on the inside, constructed of a 9-inch ring of concrete lined with blue bricks. Only one pipe has been laid for the present supply, but when the scheme is complete, there will be three of these 45-inch pipes, while the culverts and tunnels will remain as at present. There are valves every half mile, and if the pipe bursts, the valve shuts off the water automatically above the break.

Up to July 14, 1910, $14,000,327 had been expended on the works, and the final outlay for the entire scheme is expected to reach $34,065,500. The city of Nottingham will make an annual contribution of $121,662 toward the sinking fund, interest, and maintenance charges, and will receive in return 2,000,000 gallons of water daily, equal to about one-quarter of the amount at present distributed by the Nottingham water department.

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**Water Works Extension in Norfolk, Va.**

The inadequacy of the distribution system of the Norfolk water works has been made the subject of a report by the National Board of Underwriters. This report is substantiated by the investigation conducted by Mr. Nicholas S. Hill, engineer, who was retained by the city. In his report Mr. Hill makes the following statements:

There are at present about 72 miles of pipe in the distribution system of the municipal plant, covering the first six wards of Norfolk. Of this pipe 72 per cent. is 6 inches in diameter or smaller. During the period from 1904 to 1909 but 10 miles of new pipe was added to the distribution system, of which 67 per cent. was of 6 inches in diameter or smaller. The policy of laying small mains, which are practically useless for fire purposes, has been continued up to the present time. No material reinforcement of the larger supply mains has been made during the past ten years and the capacity of pipes and mains added has not been commensurate with the growth of the city. The first mains were laid in 1873, and some of them are still in use, the result being that the older pipe is highly tuberculated and its carrying capacity is materially reduced.

The number of public hydrants is inadequate. The average linear spacing of hydrants in the congested value district is 320 feet and in the residential districts about 530 feet. Many of the hydrants are of obsolete design. Tests made by the Board of Underwriters upon the free flow from hydrants, which give the probable amount of water available for fire engine supply, show that this amount is inadequate for reasonable fire protection. Tests of the drop in pressure in the mains, between the point of the test and the point where the force mains from the

pumping station enter the distribution system, plainly evidenced the inadequacy of the mains in the congested value district, the lack of large feeders and the effect of small minor distributers.

Of the two force mains, one a 30-inch pipe, is in good condition; but the 24-inch main is badly tuberculated.

The pumping station was built in 1873 and somewhat enlarged in 1892. It is of non-fireproof construction. The equipment is in good condition and efficiently handled. In the pumping station are four units with a total capacity of 22,000,000 gallons. These units are divided as follows:

10,000,000 gallon unit constructed in 1891.
5,000,000 gallon unit constructed in 1891.
5,000,000 gallon unit constructed in 1885.
2,000,000 gallon unit constructed in 1880.

The pumping capacity does not allow the necessary reserve for fire at the time of the maximum domestic consumption, in case an accident should occur to the large pump.

The filter plant was built in 1899. It consists of a coagulating basin, mechanical filters, and a clear water basin. The water is raised from the coagulating basin by low-lift pumps, situated in the filter house, and flows through the filters to the clear water basin, whence it flows by gravity to a pump well and is from there pumped to the city.

The results obtained at the plant are not as good as they should be. The reduction in color and turbidity is fairly satisfactory, but the bacterial removal is not as high as that obtained in plants operated under the best conditions. The number of bacteria in the effluent is higher than the best sanitary stardards permit.

The physical conditions of the filter plant are not good and improvements and repairs should be made if this plant is continued in use.

Mr. Hill proposes changes and extensions in the system which will provide for a reasonable growth in population and will provide a fire delivery of 7,000 gallons per minute in the congested district. The cost of the proposed work, including hydrants, gate valves, and changes in and replacement of service connections, has been estimated at $216,378, which, together with $15,981 for additional hydrants and valves to be placed on present large mains, involves a total capital outlay of $232,353.99.

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**Water Works Improvements in Rockford.**

A committee has recently returned a report to the city council of Rockford, Ill., proposing plans for the supplementing of the present water supply system. The necessity for the improvement comes through the water shortage in the summer time, or in event of a conflagration; the present system of deep wells being adequate, but the pumping equipment insufficient.

It was recommended by the committee that the present system of wells, which consists of wells Nos. 2, 3 and 5, equipped with the air-lift pumping system, shall be provided with more efficient pumping apparatus. Well No. 2 was thought to require only some repairs to the present equipment, but two plans were proposed for the improvement of the other two wells.

The first plan involved the installation of motor-driven vertical shaft-impeller pumps, the power to be procured from a local electric company. The estimate for this plan included the price of water-tight vaults in which to set the pumps and motors below the street, and suitable ventilating fans to be operated so as to prevent the collection of dampness; the access to these vaults to be provided between the curb line and the sidewalk.

The cost of the improvement under this first plan was itemized as follows:

| | |
|---|---|
| Two 8-inch pumps, with 75 horse-power motors, f. o. b. Rockford | $4,000.00 |
| Drop pipes for accommodating motor and shaft | 200.00 |
| Two vaults under street | 600.00 |
| Ventilators and fans | 150.00 |
| Erecting and connecting to present pipes | 800.00 |
| Totals | $5,750.00 |

The second plan involves the use of the air-lift system and involves the purchase of a new compressor and a boiler. The cost of the second plan is estimated to be as follows:

| | |
|---|---|
| One steam crank and fly wheel simple compressor, non-condensing | $5,000.00 |
| Foundation, erection and air pipes | 1,500.00 |
| Addition to building for compressor | 1,000.00 |
| One new 150 horse-power boiler | 2,300.00 |
| Addition to building for boiler. | 1,200.00 |
| Total | $11,000.00 |

The cost per month of operating Nos. 2 and 3 by the air lift, delivering two million gallons per twenty-four hours into the present reservoir is estimated to be as follows:

| | |
|---|---|
| 378 tons of coal at $2 | $ 755.00 |
| Three extra engineers at $65 per man | 195.00 |
| Total | $ 950.00 |

A comparison was made of the two plans, an allowance of 10 per cent per annum being made for interest and depreciation. This comparison is briefly:

| | Plant No. 1 | Plant No. 2 |
|---|---|---|
| Operating cost, power. | $2,460.00 | $2,850.00 |
| Operating cost, ventilating fans, approximate) | 150.00 | |
| Interest and depreciation at 10 per cent. | 575.00 | 1,100.00 |
| Maintenance, per annum | 150.00 | 50.00 |
| Total | $3,335.00 | $4,000.00 |

The two plans above discussed are offered only as a temporary expedient, as further extension of the present system will be necessary in a few years.

# HIGHWAYS AND LIGHTING

## Arkansas Good Roads—English Macadam Maintenance—Cement in 1910—Ornamental Street Lighting

### Maintenance of Macadam Roads in England and Scotland.

The report of U. S. Consul Fleming from Edinburgh contains an account of road construction and maintenance in England and Scotland, a short abstract of which report is as follows:

The use of tar and pitch as binding materials is becoming more general. There are four methods of applying the tar, namely: (1) Tar spraying; (2) Tar macadam; (3) Pitch grouting; (4) Tar matrix.

The methods and cost per superficial yard over ordinary macadam, detailed by the county road surveyor, are here summarized.

Tar Spraying.—It is essential that all dust and caked mud be removed from the road before the liquid is applied. After tarring, a slight sprinkling of whinstone screenings is spread over the surface. Hand tar spraying is considered superior to machines, although it costs slightly more and takes longer. In this process tar is not so much a binder as a waterproof protection to the road surface. It is soon worn away, however, and when broken up the road is thrown into an uneven and dirty condition. It is now admitted that tar spraying lasts only for one season. The life of a road subjected to much fast motor-car traffic is increased by 15 to 20 per cent. when tar sprayed. One of the main thoroughfares in Edinburgh county costs on an average $1,460 per mile per annum to maintain as at present. If tar sprayed its whole width the cost would be $1,800 per mile, after allowing for the increased life of the road, as above indicated.

Tar spraying is most suitable for county roads where expenditure is limited, and although tarring the entire surface would be preferable, a width of 10 to 12 feet in the center would accommodate motors and protect the metal bed, allowing at least double the length being sprayed, and leaving the sides with a better foothold for horses during frost.

Tar Macadam.—This consists of thoroughly mixing the stone with tar and pitch previous to its being laid on the highway. All stones should be dry, which necessitates preparation of the material under a covered structure. Tarring may be done by hand or machinery. It is usual to allow the material to lie in heaps one to three weeks to mature before applying. The coatings are applied in three layers of 2½ and 1½ inches and ½ inch stone, rolled separately, and finished with a thin layer of fine dry screenings. Tar macadam roads are easily cleaned, and the cost of maintenance on an average of years is less than ordinary macadam. It is slippery during frost and unsafe on gradients steeper than 1 in 20. Under very heavy traffic it loses its bituminous surface in two or three years, and the top layer becomes separated from that below. This system involves a comparatively heavy initial expenditure, and its general adoption on county roads would appear to be impracticable.

Pitch Grouting.—This consists of application to a scarified road, rolled smooth, of a 3 to 4 inch coat of whinstone metal, consolidated in a dry state, after which boiling pitch and tar is poured into the joints, sprinkled with small whinstone or limestone gravel, and rolled until thoroughly hard. The composition is made up as follows: Pitch (best coal tar), 1,100 pounds; refined tar, heavy bodied, 800 pounds; creosote oil, 100 pounds; total, 2,000 pounds. The mixture is applied to the roads at boiling point with spray cans, whinstone chips are immediately applied, and rolling at once undertaken. This composition is of a quick-setting nature, but retains considerable viscosity. The surface must be thoroughly dry before it is applied. The surface is smooth, but not slippery. The traffic is carried on the metal and not on the tar, as is the case with tar macadam, tar painting, or tar matrix. This is regarded as the best system for tarring county roads, as it makes them almost dustless, effects a great economy in cleaning, is easily repaired, and the life of the road is increased by at least one-third.

Tar Matrix.—There are three methods of applying tar matrix. It is usual to slightly scarify the existing road surface. The first is to spread a layer of small gravel, previously tarred, to a depth of 1 inch to 1½ inches, on which is laid ordinary road metal. This is rolled until the matrix is forced to the surface. In the second the road metal is spread first and well rolled in the dry state before the matrix, composed of tarred materials up to 1 inch in size and to the foregoing depth, is applied. This is rolled until the interstices are filled with the matrix and a smooth surface has been obtained. A thin finishing coat of finer tarred materials is usually applied, sprinkled with

dry sand or chippings, and rolled until thoroughly hard. The third or Gladwell system is a combination of the first two, having a matrix both above and below the metal.

Rocmac.—Roads made on the Rocmac system are claimed to be dustless, waterproof, economical, durable, and nonslippery. The solution is a chemical composition, made under presesure, the foundation of which is silicate of soda and sugar. The solution is mixed with high-class ⅞-inch limestone and gravel free from impurities. This is laid about 1 inch to 1½ inches deep on the road surface, which has been slightly scarified. On this is spread the ordinary macadam metal, about 3 inches thick, and thoroughly rolled until the matrix entirely fills the interstices and comes to the surface. Owing to the simple preparation of the matrix and small plant required, the work can be undertaken by ordinary workmen, but experiments have proved expensive compared with pitch grouting.

In Scotland, as well as England, county road boards that have experimented with tar macadam in constructing new roads and maintenance of old have practically abandoned it, the cost being prohibitive. Tar spraying of 10 to 12 feet in the center is generally regarded as the limit of economical treatment of macadam roads in outlying districts, and this has been restricted to main thoroughfares and village roads. For suburban roads it is likely that the use of pitch grouting will increase.

### Cement Used in 1910.

The importation of cement has steadily declined for several years; for example, from 883,418 barrels in 1908 to 454,614 barrels in 1909, and 307,699 barrels of 380 pounds each in 1910. The re-exportations in 1909 were 4,418 barrels and in 1910 were 18,856 barrels, leaving the net importations 450,196 barrels in 1909 and 288,843 barrels in 1910.

Exports of domestic cements were 846,785 barrels in 1908, 1,056,922 barrels in 1909 and 2,475,957 barrels in 1910. Exports therefore exceeded net imports by 606,726 barrels in 1909 and 2,187,114 barrels in 1910. Of the exports of domestic cement 75,666 barrels went to Panama in 1908, 438,876 barrels in 1909 and 1,528,497 in 1910. Since this cement is used on construction of works under the United States, the actual increase in exports is not indicated by the above figures. Making the deductions of exports to Panama from the total exports, the real exportation to foreign countries becomes 771,119 barrels in 1908, 618,046 barrels in 1909 and 947,460 in 1910, and it is shown that the growth in foreign trade is not as yet notably large although it shows a tendency toward an increase.

Counting the Panama shipments as domestic consumption, the excess of exports over imports is 167,850 in 1909 and 658,617 barrels in 1910.

A preliminary estimate of the production of Portland cement in the United States in 1910, made by the U. S. Geological Survey from returns made by producers of about half the amount manufactured, shows nearly 75,000,000 barrels, an increase of nearly 20 per cent. over 1909. The preliminary estimate made last year was quite far from the truth, but the returns upon which the above estimate is based are from all parts of the country and are probably within 5 per cent. The error may be greater than the total excess of exports given above.

### Good Roads for Arkansas.

The *Arkansas Gazette*, Little Rock, has issued a "Good Roads" number, a prominent feature of which is a map of a system of state pikes connecting most of the county seats of the state, and a system of county pikes supplying the omissions of roads to county seats and large towns. Sand-clay roads, macadam roads, dragged roads in Arkansas and elsewhere, are described. The provisions of a proposed good roads law are given. Much work on this line will be necessary, and the newspapers of the states can hasten the day of good roads, which can only be obtained under competent state supervision, if they will devote a page or a supplement to the question at frequent intervals, and will secure technical advice as to the material they wish to publish.

### Ornamental Street Lighting Advance.

At the present rate of regular advance in the installation of ornamental street lights, by the end of five years every city in the United States will have adopted the improved type of unit. The movement has been remarkable from the fact that instead of being first adopted by the larger cities to be later taken up by the smaller, it is finding favor with the small cities simultaneously with its approval in the larger.

In Brooklyn the Edison Electric Illuminating Co., realizing the advertising value of the decorative lighting system, caused to be printed in a local paper an attractive notice of the installation of the improved system around a building which was then in the course of construction. This advertisement had a definite publicity value to the owner of the building, the lighting company and to the company furnishing the ornamental posts. But the permanent value is entirely to the credit of the building owner.

In Prospect Park, Brooklyn, 150 gasoline lamps have been replaced by 750 ornamental standards, carrying lanterns, in which are placed 85 watt tungstens. The Municipal Art Commission furnished the design for the poles.

Illinois cities have been particularly

active of late in agitating more advanced street lighting. In Decatur, Ill., the Retail Merchants Association have planned to place 16 ornamental lights on the public square, in addition to the old arc light installation, in order to give the new system a trial. In Peoria, Ill., a petition is being circulated to extend the boulevard system, which is at present in use on S. Adams street, to Glen Oak avenue. The petition proposes that the city shall furnish the current and the property owners the lamps. Mattoon, Ill., has installed several blocks of five-light ornamental standards, and with the change to a more progressive administration in the spring election, will no doubt extend the system. Bloomington, Ill., has commenced the installation of the boulevard lights on six blocks. Five-light standards are being used, being spaced about 60 feet apart. The money for this improvement is furnished by the business men who are personally interested, and by the city. The cost of installation, of wiring and of securing the standards has been furnished by the men whose places of business will thus be made more attractive at night, and this cost has been equally divided among all who would agree to help with the plan. The city is to furnish the current, and to maintain the up-keep of the standards and lights. The system is attracting much attention and will no doubt be extended.

In McPherson, Kan., the effect of the improved lighting system on the civic pride may be noted. The town has started negotiations to procure the "White Way" system. With the possibility of obtaining these lights, and the improved appearance that it would give to the streets, local papers at once took up the matter of widening the sidewalks, the better to harmonize with the artistic lighting system.

In Dallas, Tex., a campaign has been under way to install the ornamental lights. About six months ago a meeting of property owners was called, and the ornamental street lighting of Elm street, from Austin to Ervay, considered. A special committee was appointed to visit the various business houses and solicit contracts. Exclusive of the crossings of intersecting streets, the space which is included in the boundaries set is 4,549 front feet. Contracts have been secured by which property owners have agreed to pay $2 per front foot for the installing and maintenance for one year of such devices as may be decided upon for lighting 3,193 feet. This is more than half of the total frontage within the proposed area, and it is said that the property owners of the remaining portions will doubtless sign.

Two propositions for this lighting have been submitted, one by the Dallas Gas Company and one by the Dallas Electric Light and Power Company. Mr. Babcock has mailed to the property owners blanks upon which they may express their preference. That which receives the highest number of votes will be adopted, it being understood, however, that the type of ornamental post to be used will be determined by the Chamber of Commerce.

Denison, Tex., has commenced the installation of 75-watt lamps, to replace the arc lights formerly used. According to the contract, there will be at least 239 of these lights and not more than 450. These will cost the city $1.05 each a month.

An ornamental system of street lighting has been adopted for the business district of Burlington, Ia. The cost to each merchant will be $33.33 for installation and $1.18 per month for each 20 feet of frontage.

Other cities which are contemplating the boulevard system are: Detroit, Mich.; Lawrenceville, Pa.; New Brunswick, N. J.; Mill Hall, Pa.; Altoona, Pa.; Fort Worth, Tex.; Lodi, Cal.; Dubuque, Ia.; Joplin, Mo.; Duluth, Minn.; Redlands, Cal.; Wilmington, Del.; Toronto, Can.; El Paso, Tex.; Austin, Tex.; San Diego, Cal.; Portland, Ore.; Rochester, N. Y.; Rock Island, Ill.; Freeport, Ill.; Elgin, Ill., and St. Paul, Minn.

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**A Purchaser Must Pay for Property Purchased.**

In the case of the International Harvester Company of America vs. Charles Cater, the United States Circuit Court, at Fergus Falls, Minn., Judge Willard presiding, on January 28, held that the defense that a company is a "trust" or "illegal combination" is not a good defense, either under the Sherman anti-trust law or under the laws of Minnesota.

Cater was administrator of the estate of F. L. Wilkins, deceased, of Marshall, Minn. Wilkins was an agent for the company, and the proceedings was to compel Cater to turn over the proceeds of sales that had been made by Wilkins pursuant to the terms of a commission agency contract, also to recover property and for implements sold to Wilkins.

It has also been decided recently in Michigan, Indiana and Ohio that a purchaser of an article cannot avoid paying for the property purchased by undertaking to plead the illegality of the contract of purchase and sale.

Justice Holmes of the Supreme Court of the United States, in one of his recent decisions, said: "The policy of not furthering the purpose of the 'trust' is less important than the policy of preventing people from getting other people's property for nothing when they purport to be buying it."

# MUNICIPAL AND TECHNICAL LITERATURE

## Books for Engineers—Publications Received

### Books for Engineers.

The Encyclopaedia of Municipal and Sanitary Engineering. A handy working guide in all matters connected with municipal and sanitary engineering and administration. Edited by W. H. Maxwell, A. M. Inst. C. E., and J. T. Brown, M. R. San. Inst. Cloth, 561 pp. quarto, $10. D. Van Nostrand Company, New York.

The titles of the longer articles in this volume will indicate its scope. Water supply and water analysis take the most space of any one subject, unless possibly sewerage and sewage disposal. Then follow roads, streets and pavements. Other lengthy articles are on baths, conveniences underground, destructors, disinfection, distributors for sewage, electricity, flow in pipes and conduits, gas, heating, indicator, plumbing, pumps and pumping machinery, retaining walls, ventilation, etc. Numerous short articles cover the field with very reasonable completeness.

In so small a number of pages of large type with numerous illustrations it is, of course, impossible to cover the field thoroughly, and the treatment of subjects must therefore be somewhat elementary in its nature. The subjects seem to be cross-referenced quite well. There is one peculiarity about the arrangement of subjects which must be recognized before searching for a subject not likely to be cross-referenced. It may, perhaps, be stated as a tendency to enter the subjects under a principal adjective rather than the fundamental substantive. Thus, what the American world call a driven well is to be found under Abyssinian and under American tube well with a cross reference to Abyssinian tube well, and is not to be found under driven, tube or well. Adams' sewage lift, aerating tiles, air compressor, artisan's dwellings, and the like are found under the first word of the title and not under any other word thereof. This is perhaps not objectionable when one learns the system.

Handbook of Cost Data for Contractors and Engineers. A reference book giving methods of construction and actual costs of materials and labor on numerous engineering works. By Halbert P. Gillette. Cloth, 1900 pp., $5. Second edition. The Myron C. Clark Publishing Co., Chicago, Ill.

This second edition is vastly larger than the first and may be more valuable if one knows how to use the information it contains and is careful to check up before applying it to any particular case.

The book is practically all the product of the scissors and paste pot, and the attempts at correlation of the data thus put together are not always happy or safe. Authority for much of the material is given, but the date and place are not always definite and the place to find the original publication is very often not mentioned. Credit is given to numerous periodicals and society publications in a wholesale manner in the preface, but it should be possible to trace to their original source such data as are given in this book, and there should have been the most punctilious reference in every case, not only to the author or compiler, but to the exact location of its published forms, that the reader may be able to follow up any detail or statement concerning which he has doubts or desires for further information. Numerous references are made to the periodical of which the author is an editor, but many of them are to republications, often in condensed or rearranged form rather than to the originals, and are, of course, no nearer originals than the statements made in the book.

Within the limits thus set, the book will be found of great value and the engineer possessing it will find it one for constant reference, even if he does find it to fail him on just the detail for which he specially needs help.

To show the scope of the book, the following abstract of the table of contents is made:

The introduction, 6 pages, gives the argument for cost keeping and the publication and use of cost data.

The first section, 112 pages, states the principles of engineering economics and cost keeping and is taken largely from the author's book on that subject.

The second section, 52 pages, covers earth excavation; the third, 87 pages, rock excavation, quarrying and crushing; the fourth, 217 pages, roads, pavements and walks; the fifth, 55 pages, stone masonry; the sixth, 111 pages, concrete and reinforced concrete construction; the seventh, 161 pages, water works; the eighth, 143 pages, sewers; the ninth, 124 pages, timber work; the tenth, 109 pages, buildings; the eleventh, 293 pages, railways; the twelfth, 246 pages, bridges and culverts; the thirteenth, 28 pages, steel and iron construction; the fourteenth, 34 pages, engineering and surveys; and the fifteenth, 62 pages, such miscellaneous data as could not be classified under any of the foregoing headings.

**Publications Received.**

Education Department Bulletin, New York State Library, February 1, 1911, containing American Ballot Laws, 1888-1910.

Thirty-Seventh Annual Report of the Secretary of the State Board of Health of Michigan, year ending June 30, 1909. Frank W. Shumway, Secretary, Lansing, Mich.

Annual Report of the Board of Public Works of the City and County of San Francisco, Cal., year ending June 30, 1910. Marsden Manson, City Engineer.

A City Plan for Rochester, N. Y., a report prepared for the Rochester Civic Improvement Committee by Arnold W. Brunner, Frederick Law Olmsted and Bion J. Arnold. Charles Mulford Robinson, Secretary.

Twenty-Fifth Annual Report of the Bureau of Water, Schenectady, N. Y., year ending November 1, 1910. George Haltzmann, Superintendent.

Transactions of the Appalachian Engineering Association, parts 2, 5 and 6. Henry M. Payne, Secretary, Morgantown, W. Va. Quarterly, $5 a year.

Report of Council of Canadian Society of Civil Engineers for 1910. C. H. McLeod, Secretary, Montreal, Que.

Annual Report of the Municipal Officers of Eden, Me., for 1910. Edgar I. Lord, town engineer, Bar Harbor, Me.

How to Read Plans. A simple practical explanation of the meaning of various lines, marks, symbols and devices used on architectural working drawings, so that they can be correctly followed by the workman. By Charles G. Peker. Second edition, revised and enlarged. Fifty cents. Industrial Book Co., New York.

Report of work accomplished from August 1 to December 31, 1910, by the Mine Rescue Commission of Illinois. H. H. Stoek, Secretary, Urbana, Ill.

Statistics of Cities having a population of over 30,000 for 1908. U. S. Department of Commerce and Labor, Bureau of the Census. E. Dana Durand, Director.

Sixth Annual Report of the State Highway Department of Ohio, year ending November 15, 1910. James C. Wonders, State Highway Commissioner, Columbus, Ohio.

# ORGANIZATIONS AND INDIVIDUALS

**Ohio Engineers—Mechanical Engineers—City Planning Conference—Technical Associations—Calendar—Technical Schools—Civil Service—Frederick L. Ford—J. T. Fanning—W. Fred Main—Personal Notes**

**Ohio Engineering Society.**

The annual convention of the Ohio Engineering Society was of unusual interest.

Considerable time was devoted to consideration of the proposed bill, providing for the registration and examination of civil and mining engineers and surveyors, which was introduced in the state legislature following its indorsement by the society.

The president, E. G. Bradbury, of Columbus, in his address, pointed out some of the causes of unsatisfactory professional conditions, especially calling attention to the frequency with which engineers permit themselves to be handicapped by insufficient force, and the evils of price competition.

The construction of bituminous macadam roads was treated by James T. Voshell, assistant engineer Office of Public Roads, United States Department of Agriculture. Will P. Blair, secretary National Paving Brick Manufacturers' Association, presented a paper on the manufacture of paving brick and their use in street and road construction.

The road laws of Ohio were outlined by James C. Wonders, State Highway Commissioner, who also described proposed legislation prepared by him under instructions of the legislature. The location of roads is to be placed in the hands of the county surveyor, and a highway superintendent will be placed in charge of all completed roads, and will detect and repair defects. The county surveyor will act as such superintendent on county roads, and an elected official on township roads, under the supervision of the surveyor.

D. W. Seitz, assistant State Highway Commission, presented a paper on the maintenance and repair of macadam roads.

A novel arch concrete bridge near Cincinnati was described in a paper by E. A. Gast. The bridge has a span of 73 ft., with 31 ft. roadway and 50 ft. over all width. The concrete floor slab is supported on transverse reinforced girders hung from two reinforced hingeless arches built entirely above the floor level. Thrust is provided for by tension steel in

the floor slab, thus relieving the abutments. The bridge is designed to carry two 40-ton traction cars. The floor and haunches were built on falsework, and the arches constructed last. The cost of the bridge was about $7,200.

Paul Hansen, State Sanitary Engineer of Kentucky, Wm. H. Dittoe and R. W. Ferris, assistant engineers Ohio State Board of Health, presented a symposium on the operation of sewage purification works. Mr. Hansen urged the employment of competent men, the keeping of records, the use of measuring devices and careful attention regarding neatness and appearance. Mr. Dittoe discussed in detail the operation of sedimentation tanks and sprinkler nozzles, and called attention to the intelligence and care necessary for their maintenance. Mr. Ferris treated the operation of the intermittent sand filter and contact bed in a comprehensive manner.

"The Province of Disinfection," was the title of a paper by Clyde Potts, consulting engineer, New York. Mr. Potts considers sodium hypochlorite preferable to calcium hypochlorite for use in connection with water supplies, but believes that chloride of lime at $30 per ton is cheaper than sodium hypochlorites where electric currents can be obtained for 1 cent per k. w. hour. The use of hypochlorites is recommended as an emergency measure in case of epidemic, and in small proportions for the treatment of filtered water, thereby avoiding the necessity of overdosing with alum to secure bacterial efficiency. Dininfection of sewage effluents discharged into potable waters or waters containing shell fish is also advised.

Philip Burgess, consulting engineer, Columbus, read a paper entitled "Some Features of the Design of Infiltration Plants," in which he called special attention to the fact that water drawn from sand or gravel deposits beneath the bed of a river frequently proves to be ground water flowing to the river rather than filtered river water, and outlined the studies and tests necessary for proper design of a plant of this type. Where a permanent supply can be thus obtained, Mr. Burgess considers infiltration plants very satisfactory and economical, assuming that disinfection be resorted to when necessary to produce proper bacterial results.

Several other very interesting papers were read and discussed.

The following officers were elected for the ensuing year: President, Hugh K. Lindsay, Columbus; vice president, Frank R. Landor, Cleveland; secretary-treasurer, C. J. Knisely, New Philadelphia.

The following resolution was adopted by the society:

Be it resolved, by the Ohio Engineering Society in convention assembled, that it is the sense of this society that the employment of any expert or consulting engineer by any municipality, having a regularly employed engineer, should be only undertaken on recommendation of such regularly employed engineer, and that the selection of such consultant or expert should be by him; and that the committee on legislation be instructed to consider the feasibility of preparing and introducing such measures before the General Assembly of the State of Ohio as will render the procedure herein outlined mandatory upon the officials of any municipality within the State.

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**The American Society of Mechanical Engineers.**

The sixty-third meeting of the American Society of Mechanical Engineers will be held in Pittsburg, Pa., from May 30 to June 2, inclusive.

The American Society of Mechanical Engineers is one of the foremost organizations of technical and professional engineers in the world, with a membership of over 4,000 in this country and abroad. The headquarters of the society are in New York City. Col. E. D. Meier, of St. Louis, is president this year. The society has in the Pittsburg district alone a membership of about 160.

An executive committee consisting of E. M. Herr, chairman, George Mesta, J. M. Tate, Jr., Chester B. Albree, D. F. Crawford, Morris Knowles and Elmer K. Hiles, secretary, will have charge of the Pittsburg meetings. There will be professional sessions, when papers will be read and discussed. There will also be inspection trips through the leading local industrial establishments, besides automobile trips through the parks, a visit to Carnegie Institute, Memorial Hall, etc.

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**National Conference on City Planning.**

The Third National Conference on City Planning will be held this year at Philadelphia, May 15, 16 and 17. Since the very successful conference at Rochester in May, 1910, the value of such a meeting is becoming more generally recognized not only among architects and engineers, but among city officials of broad view, and business organizations of progressive spirit. Prepared papers will serve merely to guide the discussion into specific channels and avoid waste of time in random talk.

Among the papers which will be presented are the following: "Street Widths and Their Subdivisions for Various Purposes," Mr. Nelson P. Lewis, Chief Engineer Board of Estimates and Apportionment, New York City; Mr. John Nolen, Fellow A. S. L. A., Cambridge, Mass.; Mr. Charles Mulford Robinson, Rochester, N. Y. "The Principles of a Uniform American City Planning Act," Andrew Wright Crawford, Esq., Associate City Solicitor, Philadelphia; and "Taxes, Assessments and Condemnation," Hon. Lawson Purdy, LL. D., President Department Taxes and Assessments, New York City.

In connection with the conference the first municipal exhibit of city planning will be held at City Hall, to which councils have appropriated $10,000. A city planning automobile tour of the city is being planned for the members of the conference and specially invited guests.

A cordial invitation is extended to all who are interested in city planning to attend the sessions of the conference. For further information regarding the program, or details of membership, inquire of the secretary, Flavel Shurtleff, 19 Congress street, Boston, Mass.

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**Technical Associations.**

The Northwestern Cement Products Association held their seventh annual convention at Minneapolis, Minn., February 28 to March 1. Among the papers presented were the following: "Stucco Finishes," Ernest McCullough, Chicago; "Cement Drain Tile Plants," C. M. Powell, Chicago; "Economics in Concrete Construction," Albert A. Pollard, Minneapolis; "Manufacturers of Cement Drain Tile," Chas. E. Simms, Worthington, Minn.; "Cast Stone Work," C. A. Turner, Minneapolis, and "Concrete Highway Bridges," A. E. Lindau, St. Louis, Mo.

The Lake Michigan Sanitary Association, composed of representatives of municipalities and states fronting on the lake, engineers, health officers, etc., held their fifth annual meeting at Chicago, February 13. W. D. Weiss was elected president, and W. P. Humphrey, secretary.

At the monthly meeting of the New England Water Works Association, held in Boston on March 8, the following papers were presented: "The New England Portion of the Proposed Atlantic Inter-Coastal Water Ways," Edward Parrish, assistant U. S. engineer, Newport, R. I.; "The Reforestation of Watersheds for Domestic Supplies," F. W. Rane, state forester of Massachusetts.

At the twenty-seventh annual meeting of the Connecticut Society of Civil Engineers the following officers were elected: Charles A. Ferry, New Haven, president; A. W. Sperry, New Haven, first vice-president; S. E. Minor, Greenwich, second vice-president; J. F. Jackson, New Haven, secretary.

At the organization of the Association of Borough Officials of Pennsylvania the following officers were elected: President, T. F. Chrostwaite, Hanover; secretary, Raymond Staub, New Oxford; treasurer, John C. Nissley, Harrisburg.

At the organization of the South Dakota Engineering Society at Pierre recently, the following officers we erelected: President, S. H. Lea, state engineer, Pierre; vice-president, A. B. McDaniel, professor of civil engineering, State University, Vermillion; secretary-treasurer, R. G. Gulbertson, secretary the Missouri Valley Engineering Company, Mitchell.

The Oregon Society of Engineers was organized on February 6. A charter membership of 160 is recorded. The following officers have been nominated: D. C. Henry, consulting engineer U. S. Reclamation Service, president; C. E. Bliven, secretary; F. A. Naramore, assistant engineer Northwest Bridge Company, treasurer.

The New England Contractors' Association was organized at Boston recently with a membership of about 25. Among the supporters of the organization are the following well-known firms: Holbrook, Cabot & Rollins Corporation, Stone & Webster, W. L. Hiller, Warren Brothers, Ward Brothers, Hanscom & Co., Fred T. Ley & Co., Charles R. Gow, Stewart & Sons Co., H. P. Converse, A. D. Fuller, Eastern Bridge Company, P. B. Elkins, Osgood Construction Company and Messrs. Smith, Cashman & Gray.

The Engineers' Club of Minneapolis held a meeting on March 14. A movement was started to unite this club with that of St. Paul into one organization. Capt. George R. Freeman, U. S. Army engineer, gave a description of the construction of a high dam at Minnehaha Park, and Walter Goodenough, of Boston, spoke on "The Construction of a New Power Plant for a General Company."

At the meeting of the Municipal Engineers of the City of New York, held on March 22, a paper was presented on "A Proposed Method of Interpolating the Elevation of all Portions of a Street Surface from the Established Grade," by Vernon S. Moon, M. M. E., N. Y.

At the first annual meeting of the County Engineers of Montana the following officers were elected: L. S. Ropes, Helena, president; Frank Corr, Butte, vice president; James Bonner, Missoula, secretary and treasurer.

At the annual meeting of the Illinois Water Supply Association, held at the University of Illinois on February 21 and 22, the following officers were elecfed: O. T. Smith, superintendent Water Company, Freeport, Ill., president; R. R. Parkins, superintendent Water Company, Elgin, Ill., first vice president; C. H. Cobb, superintendent Water Company, Kankakee, Ill., second vice president; H. M. Ely, superintendent Water Company, Danville, Ill., third vice president; E. Bartow, secretary-treasurer. Among the papers presented were: "Rate Making," by F. C. Jordan, of Indianapolis, given on another page of this issue; "The Water Supply and Public Health," T. W. Bath, M. D., commissioner of health, Bloomington, Ill.; "A Simple Orifice Bucket for Measuring Water," M. L. Enger, associate in theoretical and applied mechanics, University of Illinois; "Ozone Experiments in Water Treatment," W. F. Monfort, chemist St. Louis water department, St. Louis, Mo.; "Some Notes on Deep Well Pumps," F. C. Amsbury, superintendent and manager C. & U. Water Company, Champaign, Ill.;

"Diagram for Friction Loss in New Cast-Iron Pipe," A. N. Talbot and M. L. Enger, University of Illinois; "Fallacies in the Bacterial Control of a Sewage Purification Plant," Dr. Arthur Lederer and Frank Bachmann, sanitary district of Chicago; "The Action of a Slow Sand Filter During the Process of Filtration," F. D. West, chemist in charge, Torresdale Laboratory, Philadelphia, Pa.; "Uncertain Yield in Drift Wells," G. C. Habermeyer, Assoc. in Mun. and San. Engr., University of Illinois.

The third annual convention of the American Highway League was held in St. Louis on February 23 to 25. A number of papers of technical interest were presented.

At the regular meeting of the Engineering Society of Wisconsin the following officers were elected: President, Fred G. Simmons, Milwaukee; vice president, P. H. Commonway, Racine; trustees, G. H. Randall, Oshkosh, and F. A. Vaughan, Milwaukee. Mr. W. G. Kirchoffer declined re-election as secretary and treasurer.

At the meeting of the Western Society of Engineers, held in Chicago on March 15, Dr. W. F. M. Goss, dean of the College of Engineering, University of Illinois, presented an interesting paper on the Illinois experiment station in its relation to the public. The paper dealt with the testing and research work of the station and was illustrated by slides.

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**Calendar of Technical Meetings.**

American Electrochemical Society.—Annual meeting at New York City, April 6-8. Secretary, Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

National Fire Protection Association.—Annual meeting at New York City, May 23-25. Secretary, F. H. Wentworth, 87 Milk street, Boston, Mass.

National Electric Light Association.—Annual convention at New York City, May 29 to June 2, inclusive. Secretary, T. C. Martin, 29 W. 39th street, New York City.

American Water Works Association.—Thirty-first annual convention, Powers Hotel, Rochester, N. Y., June 6-10. Secretary, John M. Diven, 14 George street, Charleston, S. C.

International Association of Chiefs of Police.—Eighteenth annual convention, at Rochester, N. Y., June 11-16. President, Major Richard Sylvester, Superintendent of Police, Washington, D. C.

New York Association of Chiefs of Police.—Annual convention, Rochester, N. Y., June 13-18.

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**Technical Schools.**

"An Investigation of Built-Up Columns Under Loads," by Arthur N. Talbot and Herbert F. Moore, is issued as Bulletin No. 44 of the Engineering Experiment Station of the University of Illinois.

Sanitary analyses for Michigan state institutions and public corporations will be made free of charge by the University of Michigan. The work of analysing drinking water, etc., for communities throughout the state has long been recognized as part of the university's work for the people of the state, but hitherto ten dollars has been charged for each test made. By resolution of the board of regents, at their January meeting, "all sanitary analyses for state institutions, municipalities, villages, counties, and townships of the State of Michigan shall be furnished, without charge, from the university laboratories."

The February number of *The Wisconsin Engineer* contains two articles of particular interest. The first of these, "Refractory Materials," is a very complete illustrated discussion of the subject of materials used in the walls, hearth and roof of a reverberatory furnace, by F. T. Harvard, assistant professor of mining. The second is a complete description with diagrams of the organization of the University Extension Division, by E. D. Norris, assistant professor of mechanical engineering.

The March number of the *Wisconsin Engineer* contains among other articles of interest: "The Removal of Brass from Iron;" "The Development of the Metal Filament Lamp;" "An Engineering Trip Through Europe;" and "Technical Journalism."

Purdue University has issued a booklet, illustrated with photographs and descriptions of their various shops and mechanical laboratories.

There have recently been installed at the University of Illinois, two electric furnaces. One of these is a Hoskins resistance furnace and the other a Colby induction furnace. Both are of 20-k. w. capacity. The furnaces will be used for the purpose of studying the changes that can be brought about in the mechanical and physical characteristics of cast-iron through the influence of the soaking process.

Moses Nelson Baker, editor of *Engineering News*, New York, and a widely known author of technical books and articles, on March 17, delivered an address at the Clarkson Memorial School of Technology on the subject of "The Engineer and Social Service." The occasion was the celebration of the fifteenth anniversary of the founding of the institution.

The Congress of Technology with which the Massachusetts Institute of Technology will celebrate on April tenth and eleventh the fiftieth anniversary of the granting of its charter, promises to be of unusual interest, not only as marking a period in the development of one of the world's greatest technical schools, but because it marks also the rise and high development of all that is now included under the names of "engineering," and

"applied science." The sessions of the Congress, all of which will be held in the buildings of the Institute of Techology, will open on Monday afternoon, April 10, with an address by the president of the institute. On the second day, papers of general engineering interest will be presented in the various buildings of the institute.

The Board of Trustees of the University of Illinois announces a gift by Mr. Francis John Plym of the class of '97, amounting to one thousand dollars per annum for a term of years, for the purpose of establishing an advanced fellowship in Architecture. The name adopted by the trustees to designate this gift is the Francis J. Plym Fellowship in Architecture. The administration of the Fellowship, and the nomination of candidates have been placed in the hands of a committee to be known as the Francis J. Plym Fellowship Committee, and to this committee there have been appointed, for the current year, Messrs. J. C. Llewellyn, I. K. Pond, George C. Nimmons, practising architects, and Professors F. M. Mann and C. N. Ricker of the Department of Architecture of the University of Illinois. The award of the Fellowship will be for the year 1911-'12.

### Civil Service Examinations.

The United States Civil Service Commission announces examinations at the usual places, as follows:

April 12: Junior engineer (mechanical), bureau of mines, at from $900 to $1,380 per annum.

April 22: Assistant director office of public roads, Department of Agriculture, at $3,000 per annum. Draftsman, cartographer (male), Philippine service, at $1,800 per annum.

### Frederick L. Ford.

City Engineer Frederick L. Ford, for the past fifteen years in the service of the city of Hartford, has resigned to go into business on April 1 as a member of the engineering firm of Ford, Buck & Sheldon; his associates being the members of the present firm of Buck & Sheldon, Henry Robinson Buck and Paul Sheldon, formerly in the office of the city engineer.

Mr. Ford was born May 1, 1871, at North Branford. He was graduated from the Hillhouse High School, Ned Haven, in 1890, and from Sheffield Scientific School, Yale University, in 1893. The next three years he was in the office of Albert B. Hill of New Haven, doing general engineering work on trolley surveys and construction, state highway work, sewage disposal, etc. In 1896 he became assistant city engineer of Hartford, and in 1902 he was made city engineer, succeeeding C. H. Bunce. Besides the offices in this city which he has been mentioned as holding, he is a member of the state arsenal and armory commission and had important work to do at the time of the dedication of the building.

Mr. Ford has been president of the Connecticut Society of Civil Engineers, and is a member of the American Socity of Civil Engineers. He has been prominent in the work of the American Civic Association and the National Conference on City Planning and is known in his profession throughout the country.

Engineer Ford has many publications to his credit, dealing with various matters of importance in city development. He has discussed overhead wires, public comfort and trolley waiting stations,

FREDERICK L. FORD.

grouping of public buildings and many other subjects, his discussions being in print and on the platform. His lectures have been illustrated by photographs which he has taken on his travels in this country and abroad. He has been especially interested in matters connected with city planning, and in his new connection will make a specialty of that line of work.

### W. Fred Main.

W. Fred Main, of the Chicago Portland Cement Co., one of the best known cement salesman in the middle west, died at his home, 2921 Washington Boulevard, Chicago, March 15, after a brief illness. Born in Chicago in 1855, Mr. Main grew up with the city, and was educated in its

schools. Mr. Main became connected with the Chicago Portland Cement Co. about 1902. His efforts in recent years have been mostly confined to Chicago and adjacent territory, but at conventions and shows held further afield, Mr. Main was always on hand to greet his many friends. He was a member of the National Association of Cement Users, Iowa Association of Cement Users and similar organizations and as a lumberman, Mr. Main was identified with the Illinois Lumber and Builders Supply Dealers Assn. and

W. FRED MAIN

the Wisconsin Retail Lumber Dealers Assn.

### J. T. Fanning.

John Thomas Fanning, M. Am. Soc. C. E., for many years one of the most noted hydraulic engineers of the country, died at his home in Minneapolis, Minn., on February 6, after a very short illness.

Mr. Fanning was born at Norwich, Conn., on December 31, 1837. He studied engineering and architecture, enlisted in the Third Connecticut Volunteer Infantry, and, returning to Norwich after the war, practiced his profession there for about twenty years, specializing in hydraulic work.

In investigating the St. Anthony Falls water power improvements, Mr. Fanning was impressed with the features of the western country, and moved to Minneapolis in April, 1886, devoting himself almost entirely to hydraulic work. Among some of his notable works may be noted the development of water power at St. Anthony Falls, the Big Hole river in Montana, at Great Falls and Helena, Mont., and Spokane, Wash.

He has also been connected with the planning and construction of numerous water supply and purification systems.

He was the author of the well-known text book, "A Treatise on Hydraulic and Water Supply Engineering," and contributed a number of papers to the transactions of the American Society of Civil Engineers, of which society he had been a member for 38 years, and at the time of his death was a vice president.

### Personal Notes.

William Hoffman has been appointed by Mayor Kreismann, of St. Louis, to be chief mechanical engineer of the Water Department.

James L. Ferebee has been appointed resident engineer, Atlantic City drainage, Atlantic City, N. J. He had formerly been connected with the water department of Wilmington, Del.

Leo Hudson, consulting engineer, Haverstraw, N. Y., has been retained by the cities of McKeesport, Pa., and Beaver Falls, N. Y., to design systems of sewerage and sewage disposal.

Prof. W. F. Schaphorst of the Mechanical Engineering Department of the New Mexico College of Mechanic Arts, has resigned his position there to become a technical writer on the staff of A. Eugene Michel, advertising engineer, New York City.

O. S. Doolittle, for over twenty-five years in the service of The American La France Company, for the last twelve years its general manager, has resigned to accept the management of The Webb Motor Fire Apparatus Company, of St. Louis.

H. P. Mobberly, Assoc. M. Am. Soc. C. E., formerly Chief Engineer of the Paris & Mt. Pleasant R. R., at Paris, Tex., and W. A. Burton, have opened an office in the Woodruff Bldg., Springfield, Mo., under the firm name of Mobberly & Burton, for the general practice of engineering.

Prof. M. C. Whitaker, of the Department of Industrial Chemistry, of Columbia University, and formerly Superintendent of the Welsbach Co.'s works at Gloucester, N. J., has been appointed Editor of the *Journal of Industrial and Engineering Chemistry*. Professor W. D. Richardson, of Chicago, Ill., has retired as Editor because of the pressure of other work, but will continue as one of several associate editors.

George Alfred Goodenough, for several years Associate Professor of Mechanical Engineering of the University of Illinois, has been promoted to be Professor of Thermodynamics. Professor Goodenough was born in Davison, Michigan, in 1868. He was graduated from the Michigan Agricultural College in 1891, and received the degree of Mechanical Engineer from the University of Illinois in 1900. He was Instructor in Mechanics, Michigan Agricultural College, 1891-93; Instructor in Mechanics, International Correspondence Schools, 1893-95; Instructor in Mechan-

ical Engfiineering, University of Illinois, 1895-97; Special Writer and Editor, International Correspondence Schools, 1897-99; Assistant Professor of Mechanical Engineering, University of Illinois, 1899-1906, and Associate Professor of Mechanical Engineering, 1906 to date.

F. L. Fellows, Assoc. M. Can. Soc. C. E., City Engineer of Westmount, Que., has been appointed Supervising Engineer of Vancouver, B. C. Mr. Fellows expects to take up his new work about the first of May. The appointment is said to be a contract for five years, whereby Mr. Fellows will have entire control of the Public Works Department, with full power to make and carry out all contracts and to engage all members of his staff.

Andrews Allen and John A. Garcia announce the incorporation of the Allen & Garcia Company, consulting and contracting engineers, McCormick Building, Chicago. They intend to carry on a general consulting engineering practice relating to engineering structures in wood, steel and concrete, steel bridges and foundations, draw bridges, coal mining plants and power plants. As contracting engineers they propose to design and construct coal mining, handling, storage and screening plants.

John M. Farley, M. Am. Soc. C. E., and P. L. Braunworth, Assoc. M. Am. Soc. C. E., have formed a partnership under the firm name of Farley & Braunworth, for the general practice of sanitary and hydraulic engineering. In addition to the New York office, now at 527 Fifth ave., long maintained by Mr. Farley, the firm will open another office at the Wilkinson Bldg., Trenton, N. J. Mr. Braunworth has for some years been Mr. Farley's principal assistant, stationed at White Plains, N. Y.

The Cleveland Branch of the American Chemical Society at their March meeting, was addressed by William R. Hulbert, manager of sales, Goldschmidt Thermit Company, on the thermit welding process. In addition to a general description of the process and its various applications, with lantern slides, Mr. Hulbert gave a demonstration of thermit welding, comprising a number of experiments to show how the process is used commercially for repairing wrought iron and steel sections, and for welding pipes up to 4 inches in diameter.

James Nisbet Hazelhurst and Charles Louis Bates Anderson, heretofore associated as consulting engineers, under the firm name of Hazlehurst & Anderson, of Atlanta, Georgia, and Wilmington, North Carolina, announce a dissolution of partnership which took effect March 1. Mr. Hazlehurst will continue the practice of his profession as heretofore, at Atlanta, Georgia, and will complete all engagements for which the firm was obligated. Mr. Anderson retires to become associated as chief engineer with the Clarendon Construction Company, of Wilmington, N. C.

Prof. Charles Russ Richards, M. Am. Soc. M. E., Dean of the College of Engineering of the University of Nebraska, has been appointed Professor of Mechanical Engineering in charge of the department, at the University of Illinois, effective Sept. 1, 1911. Prof. Richards graduated from Purdue University in 1890 and received the degree of Mechanical Engineering from the same institution in 1895. He has been with the University of Nebraska since 1892, when he was appointed Adjunct Professor of Practical Mechanics. The new Mechanical Engineering Laboratory at the University, dedicated on Jan. 18, 1911, was built and equipped under his direction.

# MACHINERY AND TRADE

### A Motor-Propelled Sweeping and Flushing Machine.

The accompanying photograph shows a motor propelled combination street sweeping and flushing machine, demonstrations of which are now being made in New York City.

The machines, which are manufactured and operated by the Emerson Contracting Company, No. 1 Madison avenue, as was shown in the tests, can, at the will of the operators, clean the streets, either by a sweeping or a flushing process.

There is now a request before the board of estimate from the street cleaning department for $100,000 with which to purchase flushing machines. Presidents Mitchell and McAneny, in conjunction with Commissioners Edwards and Thompson, are the committee named by the Mayor to consider the advisability of the city investing in machines, and they will submit their recommendations to the board within a few weeks.

It is not intended that the machines are to be purchased by the city. The Emerson Company's offer is that the street cleaning department shall lease these machines for the use of the department and pay for such use at a stated price per 1,000 square yards of street cleaned, the Emerson Company paying all costs of operation and maintenance.

The machines, which require two men to work them, are motor-driven, and built in different sizes, and suit different conditions of traffic and street width, with a carrying capacity for sweeping proportional to the widths of brooms. The brooms are five and nine feet in width, and the sweepings are instantaneously thrown into conveyors that carry the

sweepings to the body of the machines, which hold five and ten cubic yards, respectively. The process raises absolutely no dust, thus avoiding the spreading of germs and doing away with other objectionable features of the present-day method of cleaning the streets. The machines when filled can be driven to the nearest dumping station, emptied and the work resumed.

One of the claimed advantages of the machine for flushing purposes over other types now on the market is that it will clean 1,000 square yards with 40 gallons of water, as against 400 to 650 gallons used by other machines, and wet sweepings, too, are taken up into the machine

EMERSON STREET SWEEPER.

just as expeditiously as are the dry. No sweepings are washed into the gutter, catch basin or sewer.

Commissioner Edwards and his deputies, Lynch and O'Brien; Commissioner Thompson, of the department of water supply, gas and electricity; subordinates of President McAneny, of the Borough of Manhattan, and President Mitchell, of the board of aldermen; Borough Presidents Steers and Miller, of Brooklyn and the Bronx, respectively; superintendents of the various bureaus of sewers, and a host of engineers of the various departments have witnessed the demonstrations. They all agree that the machines clean the streets thoroughly, noiselessly and dustlessly.

### The M. & M. Meter Box.

The Clarksville Foundry Machine Company of Clarksville, Tenn., are making an unusually liberal offer to introduce their M. & M. meter box. This offer is to the effect that they will ship one of their boxes on free trial to responsible parties desiring to investigate it, payment to be made after its acceptance as fulfilling their statements.

The box in question consists of only four pieces, namely: a cast-iron ring, a cast-iron lid, a cast-iron latch and a brass bolt. The cast-iron ring sets over an ordinary vitrified sewer pipe, and is held securely down by a lug on one side of the lid and the latch on the other side. The head of the brass bolt, which operates the latch, has five sides or faces, and requires a special wrench to operate it. The head of the bolt is set in a depression in the lid so that it comes flush with the top of the lid.

To remove the lid all that is necessary is to place the wrench on the head of the bolt and turn it about a quarter turn, until the latch is disengaged from the ring; the entire lid can then be removed, leaving the opening to the full size of the box, thus affording plenty of room for the removal of the meter, so that the whole box does not have to be dug up.

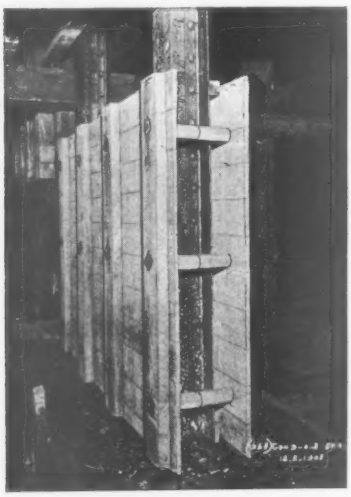
The tops are made to fit 15, 18 or 28-inch sewer pipe; or if so desired the box

may be made of brick or concrete, and be brought to the necessary size at the top. It is recommended that the meter be installed about midway between the bottom and the top of the box, thus providing an air space above and below the meter, and placing it in the warmest part of the box. This also allows of a space beneath for the collection of any waste or seepage water; or, if so desired, the bottom may be concreted and the joints filled, assuring a water-tight box.

The notable features of the M. & M. box are its cheapness, accessibility for reading and the facts that it does not have to be dug up for the purpose of removing or repairing the meter, protects the meter from frost, and is easily installed by ordinary workmen.

**McCarty Patent Concrete Separator.**

The accompanying photograph shows the McCarty Patent Concrete Separator



McCARTY PATENT CONCRETE SEPARATOR.

in use upon wall forms. As will be noted, the separator consists of a concrete tubelike device through which bolts are passed, allowing the forms to be held tightly together, offering the required resistance to compressive action between them. The separators are manufactured in standard lengths of 4, 5, 6 and 8 inches, which sizes are kept in stock. When the distances between forms are greater than 8 inches, the separators may be used in combination to secure the desired length. The holes through the separators are ⅞ of an inch in diameter, giving ample clearance for ⅝ inch bolts to be passed.

They are made of a rich grade of concrete by an especially designed machine. By reasons of the material of their construction, they make a bond with the concrete in the forms and become an integral part of the structure and being of exact length, they give a uniform distance between forms. Another advantage of the concrete separator is the fact that as there is an absence of metal in their construction, there will be no rust streaks upon wall surfaces due to rusting, as is sometimes noted when iron separators are used. Upon removal of the forms the resultant holes may be left for the passing of wire or pipes through the wall or to support temporary scaffolding; or they can be entirely filled with concrete.

The separators are convenient for use in connection with the various systems of metal and collapsible forms now on the market.

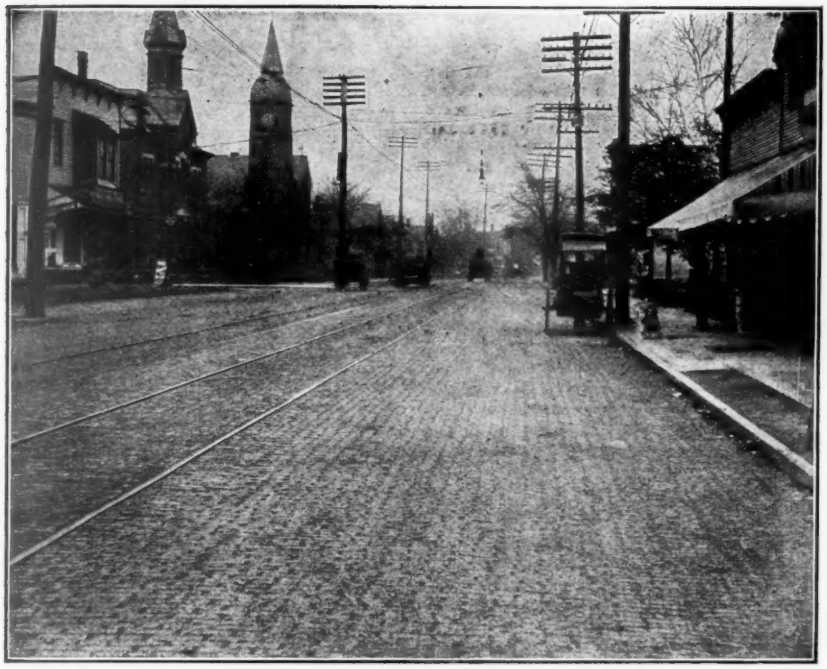
More complete information may be had upon application to the Concrete Separator Co., 1123 Broadway, New York City.

**The Record of Pitch Filler in Akron, Ohio.**

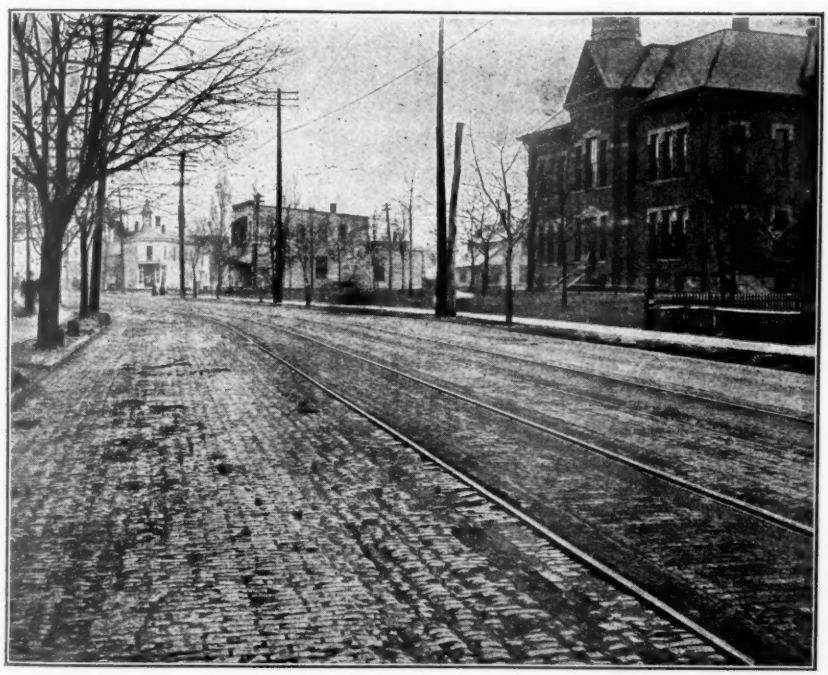
At the close of the year 1910 the city of Akron had over 65 miles of paved streets, of which over 80 per cent. are of brick. The first brick pavements laid in Akron were put down in 1890 on a sand base and paving pitch was used for a filler. These streets after twenty years of continuous usage are in good condition today, and not one cent has been spent for repairs other than to replace portions torn up to make water, gas, sewer and electric connections. Pavements have been laid on crushed slag, crushed stone, gravel and cement concrete foundations, and the pitch filler used has proven satisfactory on all kinds of foundations.

One of the things on which the Akron authorities base their preference for pitch filler is a direct comparison of results on Main street. In 1891 Main street, north of Thornton, was paved with brick with pitch filler. Five years later the adjoining section south of Thornton was paved with brick with cement filler. It would be logical to suppose that the pitch-filled section, being five years older, would wear out first. The reverse, however, is true, and the cement-filled section, as shown by the photographs, is in very inferior condition as compared with that where the pitch was used. The comparison is more than fair to the cement filler, as the pitch-filled section is nearer the center of the city and receives more traffic than the grouted section. Cement was used elsewhere in Akron about the same time, and the results were everywhere so disastrous that for the last ten years paving pitch has been used almost exclusively.

The grade on these streets varies from less than 1 per cent. to over 9 per cent., yet the pitch filler has been found well adapted to all conditions, keeping the foundation dry, and therefore firm, affording a good foothold to horses; and when necessary to take up the pavement for any reason the work can be done without breaking the brick, and when



MAIN STREET, NORTH OF THORNTON STREET, AKRON. O.
Twenty Years Old. Pitch Filler



MAIN STREET, SOUTH OF THORNTON STREET, AKRON, O.
Fifteen Years Old. Cement Filler

properly relaid it is impossible after a few weeks to tell where the pavement has been relaid. During the year 1910 about 2,000,000 pounds of paving pitch were used in the city, while plans for 1911 call for an additional large quantity.

In addition to the work done by the city authorities quite an amount of paving has been laid by private concerns, especially in new allotments, in which pitch filler has been used in preference to any other. The largest private user in the city is the Street Railway & Light Company in paving between tracks. Ninety per cent. of the million or more square yards of brick and stone pavements in Akron have their joints filled with pitch filler.

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**Official Report of a Test of the Sieben Sewer Cleaner.**

Mr. Theodore S. Jones, Superintendent of Repairs of Kansas City, Mo., has submitted to the Board of Works of that city an official report of the test of the Sieben Sewer Cleaning System, which was held in Kansas City recently. The machine, which is manufactured by the Sieben System of Sanitation Company of Kansas City Mo., was described at some length in the January issue of MUNICIPAL ENGINEERING.

The following is a tabulated estimate of the number of feet cleaned, labor and net cost per foot, as contoined in the report:

| Cost Per Foot. | Feet Cleaned. | Cost Per Day. |
|---|---|---|
| 04.40 | 970 | $42.00 |
| Cost of moving machine and preparing for other work.. | | 14.00 |
| 04.90 | 290 | 14.00 |
| 04.90 | 290 | 14.00 |
| 02.50 | 324 | 8.12 |
| 04.51 | 309 | 14.00 |
| 02.58 | 580 | 15.00 |
| 03.80 | 314 | 12.00 |
| 01.72 | 667 | 11.50 |
| 02.65 | 832 | 22.00 |
| 02.60 | 675 | 18.00 |
| 01.85 | 683 | 16.00 |
| 02.86 | 572 | 16.00 |
| 02.65 | 565 | 15.00 |
| 02.35 | 548 | 15.00 |
| | 7,801 | $246.62 |

Average cost of cleaning sewer per foot, 3.15 cents per foot. Former cost averaged from 40 to 80 cents per foot.

Attached hereto find specified number of feet cleaned, location of same and cost of laor for each day.

Number of feet of sewer cleaned by the Sieben system in 14 days, 7,801 feet.

Cost of cleaning the same number of feet by the old method, average between 40 and 80 cents per foot. Total cost, $3,960.50.

Cost of cleaning the same number of feet under the same condition by the Sieben system at the net cost of 3.15 cents per foot. Total cost, $246.62.

A total saving to the city in 14 days of $3.713.88.

**The Twentieth Century Road Oiler.**

The use of oil as a dust layer and as a binder to provide against the abrasion of top surfaces of roads is becoming standard. There have been, however, a number of objections to this use, chief among them being the fact that it is difficult to secure an even and thorough distribution of the oil over the road surface.

The Twentieth Century Road Oiler, manufactured by Walter S. French and Company, Moorestown, N. J., seems to have overcome most of the difficulties experienced in applying the oil. It consists of a tank wagon, attached to the rear of which is a motor engine driving the oil out at a high pressure upon the surface of the road. The water from the water-jacket of the engine is carried through radiators into the bottom of the tank by large pipes which radiate heat through the oil. This decreases the viscosity of the oil and raises its temperature to a higher degree than that of the road surface, causing it to be absorbed more quickly by the road material. The system of nozzles through which the oil is forced is controlled by a single lever acting instantaneously on the flow of oil, which is easily controlled by the operator, allowing the oil to be shut off at cross walks. This control allows of the oil being shut off or turned on within one inch of a given line.

The advantages of the oiler are that it gives an even distribution over the surface of the road with no pools or puddles of oil which are so objectionable in most systems; delivery at such a temperature that it is absorbed directly into the road surface; and such control that the oil may be placed exactly in the places desired without any being distributed over cross-walks or gutter tops.

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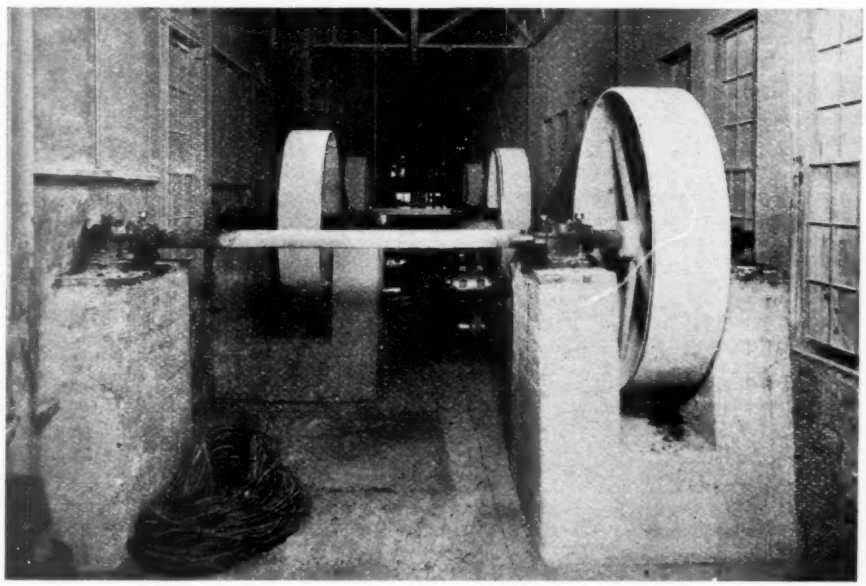
**The Matchless Patented Sanitary Street Cleaning Machine.**

The Matchless Patented Sanitary Street Cleaning Machine, manufactured by the Menzies Street Cleaner Company, 14 Maple street, Glen Falls, N. Y., has come to be so much a part of the street-cleaning equipment of the larger cities that its appearance is as familiar as the "White Wings" themselves. The machine consists of a two-wheeled cart, strongly built of steel throughout, and with wooden wheels especially built for the purpose. The dust pan, which is the distinctive feature of the machine, is constructed of galvanized iron, the blade of steel spring, 28 inches long and 6 inches wide.

The method of using the machine is so simple as to makes its efficient use possible even with the most unskilled lobar. The cart is pushed to the part of the street to be cleaned, and the dust pan lowered to rest upon the pavement a short distance beyond the dirt to be gathered up. The dirt is then swept over the blade, which rests close to the pavement, into

the dust pan. With the last push of the broom the brush is left on the dust pan and the machine is pushed to the next portion of the pavement to be cleaned. When the dust pan is nearly full, the mere action of taking the handle to pull it forward raises the pan and dumps its contents into the storage can. When the storage can is full it may be removed and hauled away to be emptied, a new one being substituted.

While the machine is designed essentially to clean streets, it may be used to advantage in parks, cemeteries, depots, hotels and public buildings. A workman can keep clean about 50 per cent. more street surface than can be accomplished by the ordinary hand cart and shovel method, and the item of saving in supplying the street department with shovels is considerable. It dispenses entirely with the use of shovel and scraper; and the saving of time, as the placing of the material in the can is continuous with the moving of the machine, is an item which will materially increase the street area cleaned.



MOTOR DRIVING CEMENT FINISHING TUBE MILLS.

### From the Raw to the Finished Product.

The accompanying illustration is taken from a booklet entitled "From the Raw to the Finished Product," recently published by the Chicago Portland Cement Company, 108 LaSalle street, Chicago. This booklet contains more than 100 halftone illustrations, and describes in detail the manufacture of Portland cement from the stripping of the soil down to the final grinding of the clinker, a subject of supreme importance to engineers, contractors and all users of cement. It is for free distribution.

### Granite Pavement.

The term granite pavement to most individuals means merely the designation of a certain kind of stone pavement; and few stop to consider that there may be as much difference in the quality of granite as there is in paving brick. The United States Arsenal at Watertown, Mass., made some tests recently of the comparative compressive strengths of various kinds of granite, which show the differences to a marked degree. Under these tests there were samples from one quarry which stood out strongly in advance of any others submitted.

These samples were from the Balfour quarry, Rowan county, North Carolina, controlled by the Harris Granite Quarries Co., Salisbury, N. C. Of six samples tested the ultimate strength per square inch ranged from 43,670 to 51,990; while the next strongest samples broke at from 27,279 to 29,347 pounds per square inch; and the others, of 16 varieties, did not approach these values.

Careful consideration of these figures will make the significance of the tests apparent. This granite is 65 per cent. stronger than any other found in America. Its crystals are so interlocked that the tendency to crumble under traffic is reduced to a minimum. In addition to this the co-efficient of wear was found to be

about 20.8, which is larger than that of trap (considered the best road metal in existence), having a co-efficient of wear of 20.6.

There are other important considerations which operate to make the product of the Harris quarries of exceptional character. The blocks are cut with true straight edges, and with faces practically at right angles with one another. This gives four serviceable heads, reducing the cost of handling in laying them; does away with the necessity of redressing them, when, after long years of service, it is necessary to relay them; and in addition there is a marked saving in the quantity of filler demanded in making the joints flush and true. This latter item reduces the maintenance expense, as the quantity of filler demanded is not sufficient to cause the blocks to float up as the filler settles.

These features are only some of the many that are noted in connection with the Harris product; and the conditional economies arising from the above may be noted upon further consideration.

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**Hendricks' Commercial Register.**

The nineteenth annual revised edition of Hendricks' Commercial Register of the United States for Buyers and Sellers has just been issued. It requires just one hundred index pages, or thirteen additional pages over last year, representing the manufacturers of over five thousand articles, none of which have appeared in any previous edition. The total number of classifications is 35,481, each representing some machine, tool, specialty or material required in the architectural, engineering, mechanical, electrical, railroad, mine and kindred industries. There is a total of 238 pages of new matter, the whole representing upwards of 350,000 names and addresses. An important feature is the simplicity of classifications. They are so arranged that the book can be used for either purchasing or mailing purposes.

The book is revised, improved and issued annually, and has been since 1891. It is expressed to any part of the country on receipt of ten dollars by S. E. Hendricks Co., Publishers, 74 Lafayette st., New York.

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**Eastern Mfg. Company's Wood Pipe.**

The drawing here reproduced shows a section of the Eastern Manufacturing Company's wood water pipe. The enduring properties of wood pipe are too well known to need comment, but the particular feature of this pipe makes it exceptionally lasting.

The pipe is made in sections of from 4 to 8-foot lengths of well-seasoned white pine or cypress staves, double-tongued together, so that they interlock and mutually support one another. The entire inner and outer joints are dressed to conform to the exact curve of the diameter of the pipe to be constructed, after which the sections are spirally banded with galvanized steel wire of 1 to 1½ inches in width, having a tensile strength of 58,000 to 65,000 pounds to the square inch. The winding is fastened to the staves by means of two galvanized nails or screws. Before the wire or banding reaches the staves of the pipe it travels through a bath of asphaltum so that the wood beneath is thoroughly covered. After banding it is coated with two coats of the best grade of asphaltum and then rolled in sawdust until the coating becomes entirely hard.

Sections of the wood pipe have been taken from the ground which have been in use for fifty-two years, and even the iron bands were in an excellent state of preservation, rust and electrolysis having had no effect.

The pipe is manufactured by the Eastern Manufacturing Company, Clinton street and Duvit avenue, Elmira, N. Y.

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**Texaco Publications.**

The Texas Company, New York City, have a number of publications which will prove of particular interest and value to the road builder. The first of these, "Texaco, the Road Builder," deals with the construction of the road, the best practice in building the surface, and the application of the binder. A number of very excellent illustrations are given throughout the books. The second booklet, "The Proof of the Pudding," is devoted to the merits of Texaco paving cement. This is also very completely illustrated. The third pamphlet deals with Texaco road oil for cold application.

In addition to these the Texas Company is issuing a regular monthly publication known as "Paving and Roads." This publication is devoted to the interests of good roads, and contains much of interest. Among the articles given in this month's issue are: "Heating and Unloading Texaco Materials when Delivered in Tank-cars," "Notes on Construction," "Quantity of Oil Required for Road Surfacing," "Road Surfacing at Glen Head, L. I.," "Cold Mixing Method," "A Picture Lesson in Good Roads" and "A Striking Example of the Use of Texaco Products."

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**Concrete Mixer Transportation by Automobile.**

In order to make prompt delivery of concrete mixers, the Standard Scale & Supply Company used a new method of handling one of their Eclipse mixers. A customer at Gary, Ind., had a breakdown on a tilting type mixer and it was necessary to have another machine on the job the next morning. The subject was taken up with the railroad company and they could not guarantee delivery by freight, and the mixer, which was

mounted on truck and equipped with gasoline engine, was too large to conveniently load in express cars, so an automobile moving van was secured and the complete mounted outfit loaded on this van at 6 o'clock in the evening and the next morning at 8 o'clock it was delivered at Gary, Ind., about 30 miles from Chicago, complete and ready for operation.

The mixer referred to has a capacity of about 100 yards per day and because of the simple construction it was possible to load the complete outfit without taking it apart and the machine being of moderate weight, enabled the automobile to handle it without any difficulty even on the country roads.

The Standard Scale & Supply Company always make special efforts to deliver promptly, mixers on rush orders and for this reason carry a large stock at their factory, branch houses and agencies and have about 25 mounted outfits ready for immediate shipment at their Chicago store and warerooms, 1341-1347 Wabash ave.

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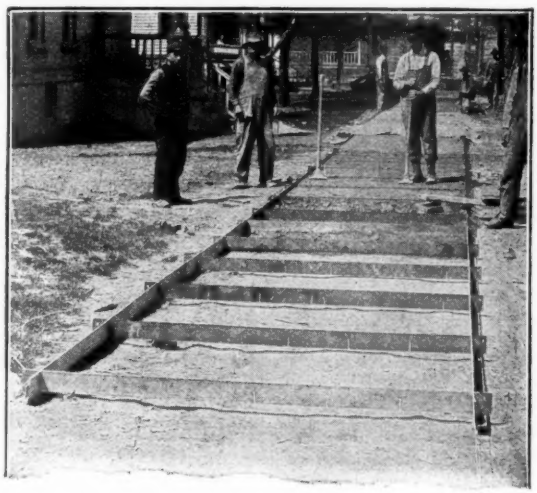
**An Adjustable Steel Sidewalk Form.**

There has been placed on the market recently, a system for building sidewalks with adjustable forms which possesses many features of superiority over the old method of using boards and stakes. These forms are shown in the accompanying illustration. They are so made as to be adjustable to any size of walk desired; for example, the six-foot cross pieces may be adjusted to range anywhere from two feet, six inches, to a full six feet. Steel spring side pieces are provided, by means of which any desired curve may be obtained. These curve forms are much more rigid and true to the desired line of curve than the old style wood strip.

The forms are manufactured by Joe Ubbink, Port Washington, Wisconsin. A ten-day free trial may be obtained upon request, with a guarantee that the purchase price will be refunded in event that they prove unsatisfactory. It is claimed that a saving of 2 cents per lineal foot can be made on all sidewalk built by these forms, as there is the saving of the initial cost of the wood forms (which are very short lived) and in addition, the labor of their construction is very much lessened. Catalogus and full information regarding the forms will be sent upon application to the above address.

An adjustable combination curb and gutter form is also manufactured by Mr. Ubbink, and is described at length in his catalog upon that subject.



UBBINK STEEL CURB AND GUTTER FORMS.

**Race Track Construction.**

"How the Race Was Run and Won" does not sound like the title of an advertising publication. Nor would the attractive three-color cover with its representation of a racing automobile impress one at first sight with the fact that the Indian Refining Company products were used in the preparation of the track for the grand prize race in Savannah, Ga., in 1910. But the attractive book, with the title above noted, is issued by the Indian Refining Company, First National Bank Building, Cincinnati, O. Almost the only evidence of this fact is the tiny copyright note on the fly-leaf.

The publication in itself is most attractive in its design and execution. It is excellently printed on heavy paper which is admirably suited for the photographs of the race and the course, which comprise the greater part of the book. The story of the great race, the official record, an historical sketch of the Savannah Automobile Club, a map of the course,

photographs of the officials and drivers, together with the photographs above noted are the contents. The borders around the pictures and reading matter are embellished with two-color drawings of the various semi-tropical plants and flowers found along the course.

The book is exceedingly original in its conception and excellently well executed in all its details.

**Mueller Sprinkling and Flushing Hydrant.**

The Mueller Manufacturing Company, Decatur, Ill., and New York City, has placed a new sprinkling and flushing hydrant on the market. It is designed for either public or private use. It is especially urged for public use to obviate the use of fire hydrants for any other purpose than that of suppressing fires.

In private installations it is of service in garages, markets and manufactories or in fact wherever large quantities of water are needed for flushing or sprinkling. The connection at the main is made with a Mueller corporation cock. The top of the box is flush with the curb.

All iron parts are galvanized, and the other parts are of brass. This box delivers a two-inch stream and is made in lengths of 2½ to 8 feet.

**Cement That Will Stand 3,000 Degrees F.**

For many years engineers have experienced great difficulty in proper maintenance of brick settings of furnaces of all types. They have been compelled to depend very largely upon the ordinary fire clay as a bonding material, and as this fuses at a comparatively low temperature, the bond between the bricks is rapidly destroyed, and the result is that the cracks are opened up between the bricks, through which the gases of combustion enter, eventually weakening the brick and causing the walls to collapse.

Every engineer realizes the annoyance and expense occasioned by occurrences of this kind.

Another feature which has been objectionable is the fact that refractory bricks become very porous on the surface and very soon the clinkers from the coals attach to the surface of the brick, and in removing these with tools the bricks are broken.

After several years devoted to research work on refractory cements to overcome these troubles, the H. W. Johns-Manville Co., New York, are now offering to the trade a line of cements called J-M Refractory Cements for furnace setting of various types, cupolas, lining brass furnaces, assayers' crucibles, oil burning, tilting and rotary furnaces, and for patching and facing bricks in place in the fire zone under various conditions.

These cements are rated to resist temperatures as high as 3,000 degrees F.

They have also produced a coating for walls known as J-M Brickline Cement, which prevents clinkers from adhering and to seal the pores of the brick.

Realizing that the conditions under which these cements are used are variable, they have been made capable of modification to meet conditions as they come up, and the Johns-Manville Co. invite the trade to place before them any conditions that are troublesome and they will be very glad to make a careful investigation and offer suggestions which will tend to overcome the difficulty.

**Trade Publications.**

The American Asphaltum & Rubber Co., 600-614 Harvester Building, Chicago, Ill., have a leaflet descriptive of a practical engineering test demonstrating the efficiency of "Pioneer" mineral rubber pipe coating for the protection of underground steel pipe lines against electrolytic action, The tests were made by E. E. Brownell, consulting electrical engineer, of Philadelphia.

The Chicago Portland Cement Co. has an illustrated booklet which deals particularly with the seventh annual convention and show of the Iowa Association of Cement Users, held in Cedar Rapids

The Marquette Cement Manufacturing Co. have a booklet of half-tones of the bridge built for the Iowa Central railway at Keithsburg, Ill.

The Atlas Portland Cement Co., 30 Broad st., New York City, has issued a small book with a description, tests and specifications for the use of stainless Atlas-White Portland cement.

Catalogue No. 6 of the Keystone Driller Co., Beaver Falls, Pa., a most complete and minutely detailed description of the Downie deep well pumps. All parts are illustrated and described in detail. In addition useful information relative to pumps in general is given.

The sixtieth year book of the Port Huron Line, issued by the Port Huron Engine Co., of Port Huron, Mich., is devoted principally to threshing machinery, though there is a small section given over to the well-known Port Huron good roads machinery. The book in itself is attractively illustrated and contains much of interest in connection with the subjects mentioned.

The McCarty patent concrete separator is described in a booklet by the Concrete Separator Co., 1123 Broadway, New York City.

The Blau Gas Company of America, 19-23 Sixth st., Long Island City, N. Y., have an attractive and instructive book upon liquified gas in steel bottles for use in illuminating country homes.

The Studebaker Co., South Bend, Ind., in the nineteenth number of their interesting little publication continue the illustrated article on the making of a wagon, this number being devoted to the number of processes involved in the manufacture of the wheels.

The Allis-Chalmers Co., of Milwaukee,

Wis., have for distribution a reprint describing the Allis-Chalmers direct connected Reynolds Corliss engines, heavy duty pattern. These engines have been on the market for about fifteen years and are used in electric power and lighting stations. The reprint also contains information required in making estimates and a discussion of direct connected vs. belt-driven units.

The Roughen adjustable street gauge, manufactured by P. Roughen, Fond du Lac, Wis., is described in a pamphlet, which is illustrated with photographs. The device is used for grading the streets after the curb and gutter are built and the concrete base is placed.

The Yellow Pine Manufacturers' Association, seventh floor, Wright Building, St. Louis, Mo., have two valuable booklets for distribution. The first of these is descriptive of "The Modern Perfect Pavement," and contains much data of value to the engineer. The second is devoted to creosoted yellow pine blocks for use in floor coverings, bridge floors, etc.

The Menzies Street Cleaner Co., 14 Maple st., Glens Falls, N. Y., have a small booklet devoted to their patented spring steel snow shovel. The tool described consists of a steel spring blade fastened to a wooden handle in such a manner that it may be easily removed when desired.

The Vulcan Portland Cement Co. have a booklet devoted to cement sidewalk paving. Full details are given concerning the method to be followed in sidewalk construction, and the points noted are illustrated by photographs from actual work.

The Fort Wayne Electric Works, of Fort Wayne, Ind., have a number of excellent pamphlets descriptive of their products.

The Universal Portland Cement Company, Chicago, Ill., have a very attractive booklet illustrated by half-tones and drawings showing the uses of concrete in the country. The material for this publication is furnished by the Association of American Portland Cement Manufacturers, Philadelphia, Pa.

The Sandusky Portland Cement Company, of Sandusky, O., have two very attractive booklets for distribution. The first of these deals with Medusa Portland cement and of the artistic effects to be obtained through its uses. The second contains a complete summary of tests and descriptive matter relative to Medusa waterproofing.

The March publication of the Lehigh Portland Cement Co. contains among other things a description of the Niles Tool Foundry at Hamilton, O., and a number of residences upon which Lehigh Portland cement was used. The April issue deals particularly with reinforced concrete bridges, and is of interest and value to the engineer.

The Buffalo Pitts Steam Roller Company, of Buffalo, N. Y., have a complete catalogue of their machinery, showing a number of rollers especially designed for road construction. Photographs are given which completely illustrate the uses and advantages of their machines.

The Canton Culvert Company, Canton, O., have a booklet which gives description, analyses and tests made upon their culvert metal known as "No Co Ro" metal.

The Reisert Automatic Water Purifying Company, 30 Church street, New York, have a pamphlet containing a complete description of their new improved Reisert patent filter. Drawings are shown to illustrate each of the points noted.

An illustrated pamphlet or catalogue describing street cleaning machines, asphalt and concrete wagons, some of them motor-propelled and some horse-drawn as well as a number of other contractors' supplies, is issued by the Briggs Labor Saving Specialty Company, Waterloo, Ia.

Catalogue "M" of the Frick Company, Waynesboro, Pa., shows a complete line of traction engines. There are particular types suitable for road construction uses which possess features of value for that type of work.

The L. M. Booth Company, New York, have an illustrated catalogue which not only describes their different types of water softeners, but which gives some valuable material on the general features of the water softening problem.

Earth handling and road building machinery are described in an illustrated catalogue by the Russel Grader Manufacturing Company, Twenty-fourth and University streets, Minneapolis, Minn. Several new types of elevating graders and ditching machines are illustrated and full described.

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### Trade Notes.

#### ASPHALT.

Chicago, Ill.—The Impson Asphalt Co. has been incorporated for the mining and manufacture of asphalt and other minerals, by Wm. S. Corbin, Joseph P. Eames and Earl F. Tilley.

#### BRICK.

Broad Brook, N. J.—The Concrete Unit and Construction Co. has been incorporated by Houghton Wheeler, Elbert V. D. Rousseau and Charles G. Little. Manufacture of concrete blocks, bricks, etc.

Houston, Tex.—Special.—The Texas Terra Cotta Tile and Pressed Brick Co. has been formed, with a capital stock of $100,000, 75 per cent. of which has already been subscribed. The incorporators of the company are Geo. Gwilt, formerly of British Columbia; Milton McConnell, of Dallas, Tex., and Clement Watson, New Waverly, Tex.

Huntsville, Tex.—Special.—Machinery for a brick plant near this city is being installed and the work of making brick will begin at an early date.

### CEMENT.

Hammond, Ind.—Special.—The Calumet Concrete Construction Co. has been incorporated by Conrad Markmueller, A. P. Larson and Albert Rose.

Indianapolis, Ind.—Schuyler C. Hubbell has been appointed agent for the Raymond Concrete Pile Co., of Illinois.

Minneapolis, Minn.—The contract for furnishing 105,000 barrels of cement was awarded to Huron Portland Cement Co., Alpena, Mich.

Bellingham, Wash.—The erection of a cement plant is contemplated by Balfour, Guthrie & Co.

Denver, Colo.—Special.—Bids will be received until April 3 for furnishing 130,000 barrels of Portland cement by the United States Reclamation Service, Denver, Colo.

Chicago, Ill.—Special.—Bids will be received until April 19 for furnishing and delivering Portland cement, crushed limestone, building sand, torpedo sand and sewer pipe. Certified check, 15 per cent. South Park Commissioners.

Indianapolis, Ind.—Special.—The Security Trust Company, of Indianapolis, will offer at public sale at the court house of Bedford, Ind., at 1 p. m., April 15, 1911, the plant and property of the United States Cement Company, near Bedford, consisting of buildings, mills, machinery, tools, fixtures, real estate on which the plant is situated, consisting of about 260 acres of land, and also of shale land in Jackson county, Indiana. Said sale will be for cash or in lieu of cash, securities that are liens on the property.

Haverhill, Mass.—Special.—The contract for furnishing cement for the year was awarded to the Haverhill Cement Co., Haverhill, Mass.

Holyoke, Mass.—Special.—Bids will be received until April 7 for furnishing curbing, cement and trap rock. Cy. clk.

Chicago, Ill.—The Lehigh Portland Cement Co. have discontinued their Indianapolis and Cleveland offices and have combined them in the Chicago office.

Pittsburg, Pa.—Special.—Mr. Charles T. Topping, representing the Chicago Concrete Machinery Company in Pittsburg territory, has opened an office in the Bessemer Building, Pittsburg. He will handle Chicago mixers, Smith hand mixers, Symons crushers, Sterling wheelbarrows, concrete cars and other contractors' equipment and supplies.

### PURCHASE OF MACHINERY.

Redondo, Cal.—The Warman Steel Casting Co., of Los Angeles, has been incorporated, with a capital of $50,000, by G. B. Warman, N. W. Warman, N. C. Heron and others, and contemplates erecting a steel manufacturing plant here.

Buffington, Ind.—The Universal Portland Cement Co., has placed an order with the Westinghouse Electric and Manufacturing Co. for motors to operate its No. 6 plant at Buffington, Ind. The motors range from 5 to 200 horsepower and aggregate 11,500 horsepower.

Wabash, Ind.—The Ford Meter Manufacturing Co., of Wabash, has been incorporated to establish and equip a factory to manufacture water, gas and electric meters. E. H. Ford, T. W. and W. A. McNamee, directors.

Ft. Wayne, Ind.—The Siler-Pettitt Manufacturing Co. has been incorporated with a capital of $250,000, to establish and equip a plant for the manufacture of pumps. E. E. Siler, B. F. Pettitt and G. S. Sanford, directors.

Clarksville, Tenn. — Special. — The Clarksville Foundry and Machine Co. have taken up the manufacture of the Morris and the Ryder meter boxes, and a number of other castings for municipal uses.

Winnipeg, Can.—The contract for furnishing two 500-k. w. generators was awarded to Siemens Bros. Dynamo Works, Toronto, Ont.; 016,410.

The following purchases of Heenan destructors, managed by the Power Specialty Co., 111 Broadway, N. Y., have been made:

San Francisco, Cal.: Two complete plants, one for Islais Creek district of 120 tons capacity per day, the other for North Beach district of 360 tons capacity per day. These two plants are designed on the unit principle, the former containing two 60-ton destructors, and the latter designed to contain six 60-ton units, only two of which, however, are being constructed at this time. New York City: One 90-ton plant for the Clifton district, containing two 45-ton units. The City of Havana, Cuba, has also placed a contract for one of the largest destructor plants ever built. This plant has a capacity of 500 tons per 24 hours, and consists of four Heenan destructor units of 125 tons each.

### SEWER PIPE.

Colville, Wash.—Special.—The contract for furnishing 3,200 feet of wood pipe and a quantity of wrapped copper pipe was awarded to George Van Tuyl, Colville, Wash., for $1,120.

### ROADS AND PAVEMENTS.

Indicating that there is to be no cessation in road construction and improvement in the Philippines, the Iroquois Iron Works, of Buffalo, has just received an order for six ten-ton macadam steam rollers for immediate shipment to Manila. At the same time the United States government ordered a ten-ton Iroquois macadam roller for delivery at Washington, D. C.

### MISCELLANEOUS.

Randolph, Mo.—Special.—Matt & Bemis, general contractors, Seward, Neb., have secured the contract to quarry and deliver at the work along the river, 40,000 yards of rock to be used in the construction of two and one-half miles of standard revetment work being put in at Randolph, Mo., opposite Kansas City, by the United States government.

The contract was awarded to Rust, Swift & Co., of St. Louis, Mo., and the rock end "subbed" to this firm. They expect to commence operations at the quarry in a very short time and begin to move the rock to the work. All of this work at Randolph will be under charge of Maj. Edward H. Schultz, engineer, United States War Department, Kansas City, Mo.

Texas City, Tex.—Texas City Electric Light and Water Co.; capital stock, $100,000. Incorporators, William Dorsett, R. C. Trube, F. N. Danforth, Clyde Amburn and Harvey A. Thomas.

Texas City Sewerage Co., capital, $50,000. Incorporators, William Dorsett, R. C. Trube, F. N. Danforth, Clyde Amburn and Harver A. Tohmas.

Columbus, O.—Special.—The contract for furnishing and delivering soda ash was awarded to Isaac Wrinkler & Bros., Cincinnati, O.; furnishing 1,400 tons of lime was awarded to American Stone & Lime Co., Tyrone, Pa.

# IMPROVEMENT AND CONTRACTING NEWS

## PAVING.

### CONTEMPLATED WORK.

Cullman, Ala.—Plans are being prepared for the construction of about 5 mi. of pavement. M. L. Robertson, myr.

Demopolis, Ala.—Contemplating the construction of about one mi. of cement sidewalks along Maine st. Jesse B. Hearin, mayor.

Fairfield, Cal.—Plans are being prepared for macadamizing 8 blocks of street in the business section. City Trustees.

Hermosa Beach, Cal.—Bids will soon be received for paving about six streets with asphalt.

Martinez, Cal.—Contemplating the construction of a road from Martinez to Bay Point. Board supervisors.

Oroville, Cal.—Contemplating the construction of a road near Swede's Flat. Board supervisors.

Pomona, Cal.—Contemplating paving Park ave. from 2nd st. to Gay ave.

San Bernardino, Cal.—Bids will soon be requested for the construction of a vitrified pipe sewer in B st. and 2nd st. Cy clk.

Jacksonville, Fla.—Plans are being prepared for paving Riverside ave. from Roselle to King sts. with asphalt.

Chicago, Ill.—March 15, constructing improvements on 23 streets. Board local improvements.

Springfield, Ill.—The paving of Pasfield and 14th st. with brick is contemplated.

Boonville, Ind.—Bids will soon be received for gravel road improvements. N. M. Spradley.

Indianapolis, Ind.—Bids were received for laying 278,000 ft. of cem,ent sidewalk in Warfleigh add., the lowest being that of Harding for about $17,500. Jeup & Moore, engrs.

Kendallville, Ind.—The paving of North Main st. is contemplated. City council.

Lagrange, Ind.—Plans are being prepared for paving Lafayette st.

Michigan City, Ind.—City engineer Miles will prepare plans for the paving of Baltimore st. from Michigan to Chicago st.; Wabash st. from Barker ave. to Earl rd.; and Willard ave. from 4th to Green sts.

Carroll, Ia.—Contemplating the paving of 5th, Main and Adams sts. City council.

Clinton, Ia.—City Engineer R. C. Hurt, has been ordered to prepare plans and specifications for paving 5th ave. from 2nd to 5th sts. with creosoted wood block paving. 12,000 sq. yds. required.

Des Moines, Ia.—Plans are being prepared for laying 14,000 sq. yds. of creosote block and 30,000 sq. yds. of asphalt. Horace Susong, clk.

Hampton, Ia.—Contemplating the paving of various streets with brick and alleys will be paved with concrete.

Indianola, Ia.—Contemplating the paving of various streets.

Villisca, Ia.—Contemplating the construction of 16,505 sq. yds. brick paving, 4,053 lin. ft. combined curb and gutter and 1,195 lin. ft. curb. Theodore S. DeLacy, Creston, Ia., engr.

Waterloo, Ia.—Contemplating the expenditure of $150,000 for paving during the coming season.

Oak Bluffs, Mass.—Voted $2,000 for road inprovements. Cy. coun.

Mankato, Minn.—The paving of five blocks with tar macadam is contemplated.

Great Falls, Mont.—The construction of 72 blocks of concrete pavement is contemplated.

Newark, N. J.—Paving amounting to $830,000 is contemplated during the present year.

Dunkirk, N. Y.—The paving of 6th st. is contemplated. Cy. engr.

Lenox, N. Y.—Voted $4,490 bonds for road improvements.

Poughkeepsie, N. Y.—Plans will be prepared for paving N. Clinton st. with brick, and Mansion st. with macadam.

Bellaire, O.—Contemplating the construction of sidewalks and curbs on various streets. G. W. Althar, clk. cy. coun.

Bucyrus, O.—Contemplating improving various highways to cost $15,000. G. F. Achermon, audt.

East Palestine, O.—Ordinances have been passed providing for the construction of sewers and paving various streets. C. L. Butts, cy. clk.

Franklin, O.—Ordinances have been passed for the paving and curbing of various streets. Cy. coun.

Portsmouth, O.—Contemplating paving Brown, Lawson and 8th sts. Cy. coun.

Youngstown, O.—Ordinances have been passed providing for the paving of various streets. Cy. coun.

Oklahoma City, Okla.—Ordinances have been passed providing for the paving of Byers and Lee avenues.

Latta, S. C.—Bids will soon be received for sidewalk construction.

Chattanooga, Tenn.—Voted $45,000 bonds for paving various streets. Cy. coun..

Brownsville, Tex.—Voted $80,000 bonds for paving various streets.

Dallas, Tex.—Bids will soon be received for paving portions of 16 streets.

Pasco, Wash.—Constructing cement sidewalks to cost $40,000 is contemplated.

### CONTRACTS TO BE LET.

Wetumpka, Ala.—Bids will be received until April 4 for grading and surfacing about 30 miles of sand clay road. Com., Elmore co.

Jacksonville, Fla.—Bids will be received until April 5 for keeping in repair the hard surfaced road known as Atlantic boulevard for a period of one year. P. D. Cassidy, clk.

Atlanta, Ga.—Bids will be received until April 3 for paving North boulevard with creosoted wood blocks. Certified check required. Mayor and gen. coun.

Dublin, Ga.—Bids will be received until April 18, 12 m., for paving about 600 sq. yds. with vitrified brick. A. P. Hilton, cy. clk.

Bedford, Ind.—Bids will be received until April 4 for constructing two gravel roads. Ezra W. Edwards, audt.

Bloomington, Ind.—Bids will be received until April 5 for constructing a road in Clear creek township. Horace Blakely, audt.

Bloomfield, Ind.—Bids will be received until April 4 for constructing two macadamized roads in Stockton township. Caswell H. Jennings, audt.

Brookville, Ind.—Bids will be received until April 7 for constructing highways in various townships. Chas. A. Miller, audt.

Brownstown, Ind.—Bids will be received until April 4, 1:30 p. m., for constructing a gravel road in Owen township. H. W. Wacker, audt.

Danville, Ind.—Bids will be received until April 4 for constructing a road in Union township. W. H. Nichols, audt.

Decatur, Ind.—Bids will be received until April 3 for constructing a macadam road in St. Mary's township. H. S. Michaud, audt.

Fowler, Ind.—Bids will be received until April 3 for constructing macadam roads in Beaver township. E. R. Bringham, audt.

Goshen, Ind.—Bids will be received until April 3, 3 p. m., for improving N. Main st. Geo. H. Rimpler, cy. clk.

Hamilton, Ind.—Bids will be received until April 6 for constructing stone and gravel roads. Geo. Griffin, audt., Noblesville, Ind.

Kentland, Ind.—Bids will be received until April 4 for constructing a macadam road on line between Washington, Iroquois and Jefferson townships. E. R. Bringham, audt.

Madison, Ind.—Bids will be received until April 4 for constructing a road in Madison township. Andrew M. Taff, audt.

Monticello, Ind.—Bids will be received until April 4 for constructing a gravel road between West Point and Round Grove townships. A. G. Fisher, audt.

Paoli, Ind.—Bids will be received until April 5 for constructing a gravel road in French Lick township. Alvin B. Ham, audt.

Rushville, Ind.—Bids will be received until April 15 for constructing two gravel and one macadam. Jesse M. Stone, audt.

Sullivan, Ind.—Bids will be received until April 4 for constructing roads in Cass township and one stone, sand, clay and oil road in Hamilton township. Ben C. Crowder, audt.

Wabash, Ind.—Bids will be received until April 4, 1:30 p. m., for improving a highway in La Gro township and April 5 for constructing a gravel road in Chester township. J. P. Noftzger, audt.

Washington, Ind.—Bids will be received until April 3 for constructing 3 gravel roads in Elmore township. Thos. Nugent, audt.

Winamac, Ind.—Bids are received until April 5 for improving four public highways. W. E. Munchenburg, audt.

Bronson, Ia.—Bids will be received until April 3 for road construction. William Pickett, cy. clk.

Cresco, Ia.—Bids will be received until April 10 for constructing about 5,500 lin. ft. cement concrete curbing and 11,500 sq. yds. cement concrete paving. Cy. clk.

Davenport, Ia.—Bids will be received until April 4 for paving and curbing various streets. Certified check, $100. Bd. pub. wks.

Cambridge, Md.—Bids will be received until April 6 for grading, curbing and paving various streets. The work includes: 16,876 sq. yds. vitrified fire clay or shale block pavement, 2,600 sq. yds. granolithic or concrete gutter, 6,400 lin. ft. straight concrete curb, 4,150 lin. ft. reinforced straight concrete curb (corner bar), 1,733 lin. ft. reinforced curved concrete curb, 32 storm-water inlets. Cambridge st. imp. com.

Ft. Hawood, Md.—Bids will be received until April 7 for constructing concrete walks. Const. q. m.

Breckenridge, Minn.—Bids will be received until April 3, 8 p. m., for constructing cement sidewalks, curbing, crossings and gutters. Check, $200. D. J. Jones, cy. clk.

Hallock, Minn.—Bids will be received until April 3 for constructing state roads and culverts. Certified check, 10 per cent. C. J. Hemingson, audt.

Fulton, Mo.—Bids will be received until April 6 for constructing 5,000 sq. yds. macadam with a binder and 3,500 ft. of concrete curb. Cy. coun.

Swedesboro, N. J.—Bids will be received until April 15 for improving Railroad avenue. Milmer Egee, mayor.

Port Jervis, N. Y.—Bids will be received until April 3 for paving portions of various streets. John F. Cleary, cy. clk.

Wahpeton, N. D.—Bids will be received until April 3, 7 p. m., for constructing sidewalks, curbs, gutters and crossings. Clark M. Olson, cy. clk.

Bismark, N. D.—Bids will be received until April 4, 2:30 p. m., for furnishing galvanized or steel culverts. I. M. Healy, audt.

Casselton, N. D.—Bids will be received until April 3 for constructing and repairing sidewalks. Certified check, $50. B. D. Youells, aud.

Grafton, N. D.—Bids will be received until April 3, 1 p. m., for constructing sidewalks, alley crossings, and street crossings. Certified check, $100. J. H. Johnson, audt.

La Moure, N. D.—Bids will be received until April 4 for furnishing sidewalks and curbs at new court house. Certified check, $100. C. J. Alister, audt.

Park River, N. D.—Bids will be received until April 3 for constructing sidewalks, crosswalks, etc. Certified check, $50. F. J. Prochaska, audt.

Canton, O.—Bids will be received until April 6 for paving various streets to cost $43,000. R. F. Hurbert, dir. pub. ser.

Cleveland, O.—Bids will be received until April 3 for furnishing material and laying cement sidewalks for one year. A. B. Lea, dir. pub. ser.

Columbus, O.—Bids will be received until April 5 for grading roadway and constructing approaches to various bridges. F. M. Sayre, audt.

Youngstown, O.—Bids will be received until April 3 for furnishing material and constructing sidewalks. Certified check, $100. H. W. Williams, cy. clk.

Lawton, Okla.—Bids will be received until April 10 for paving about 5 miles rock asphalt, base, concrete curb and gutter. Z. M. Scifres, cy. engr.

Ingram, Pa.—Bids will be received until April 3 for grading, curbing and paving Hodgon ave. D. H. Hainer, clk.

Charleston, S. C.—Bids will be received until April 4 for furnishing and constructing a vitrified brick roadway. J. H. Dingle.

Knoxville, Tenn.—Bids will be received until April 5 for constructing pavement, curbing and guttering various streets. W. P. Chandler, recdr.

Coupeville, Wash.—Bids will be received until April 5 for improving Hinman road No. 32. H. T. Wanamaker, audt.

### CONTRACTS AWARDED.

Birmingham, Ala.—The contract for paving on S. 18th st. was awarded to the Andrew Asphalt Paving Co., Birmingham, Ala., $49,000.

Birmingham, Ala.—The contract for paving Avenue F, from 18th to 27th sts., with bitulithic was awarded to Southern Bitulithic Co., Birmingham, Ala.

Eutaw, Ala.—The contract for paving the public square and Main st. was awarded to Tuscaloosa Concrete & Construction Co., Tuscaloosa, Ala., $12,000.

Los Angeles, Cal.—The following contracts were awarded: Improving San Pedro st., to Benj. F. Ford, Los Angeles, Cal., $35,295. Improving Rico st., to Barber Asphalt Paving Co., Los Angeles, Cal., $5,621.

Pasadena, Cal.—The contract for paving with oil macadam and constructing cement gutters on Orange Grove ave. was awarded to Cox & Mathews, Pasadena, Cal., $25,838.

Riverside, Cal.—The contract for macadamizing and constructing curbs and gutters on Park ave. was awarded to Johnson Shea Co., Riverside, Cal., $29,-173.

Santa Monica, Cal.—The contract for grading, paving cement curbs, sidewalks and catch-basins on Vicente Terrace Tract was awarded to Fred H. Stout, 4246 S. Grand ave., Los Angeles, Cal.

E. St. Louis, Ill.—The contract for improving Wimmer place and Alexander st. was awarded to O. T. Dunlap, Edwardsville, Ill., $33,790.

Chicago, Ill.—The following contracts were awarded: Furnishing 40,000 sq. yds. of sectional wood pavements to be delivered, to Geo. P. Cullen & Co., 78 La Salle st., Chicago, Ill.

Maywood, Ill.—The contract for paving portions of N. 6th, 9th and 11th aves. with Bessemer block was awarded to A. M. Todd, Maywood, Ill., $65,534.

Moline, Ill.—The contract for paving S. 15th st. with vrick was awarded to Britt & Layden, Davenport, Ia., $27,493.

Elkhart, Ind.—The contract for paving various streets was awarded to Daniels, List & Douglass, Anderson, Ind., $47,280.

Indianapolis, Ind.—The contract for furnishing asphalt for the city plant was awarded to California Asphaltum Sale Agency, R. R. Exchange Bldg., Chicago, Ill.

Jeffersonville, Ind.—The contract for constructing a free gravel road in Owen township was awarded to W. W. Taggart, Jefferson, Ind., $5,868.

Lapel, Ind.—The contract for constructing cement walks along Pendleton ave. was awarded to A. W. Doan, Lapel, Ind., $5,812.

Logansport, Ind.—The contract for constructing Sheetz road in Jefferson township was awarded to J. H. Nulls, Winfield, Ind., $6,743.

Portland, Ind.—The contract for constructing a road on the line between Jay and Randolph counties was awarded to Wallace & Schlechty, Portland, Ind., $17,-749.

Richmond, Ind.—The contract for paving N. D st. was awarded to Trippier & Son, Peru, Ind.; paving N. E st. was awarded to L. P. Meredith, Richmond, Ind., $21,851.

Shelbyville, Ind.—The contract for improving the Ira L. Pritchard road was awarded to C. W. Folger & Co., Columbus, Ind., $10,950.

Wabash, Ind.—The contract for improving Laketon road was awarded to Conover & Tabor, Wabash, Ind., $19,480.

Washington, Ind.—The contract for constructing the Alexander road was awarded to Mathew McGulie, Washington, Ind., $8,940.

Williamsport, Ind.—The contract for constructing a gravel road in Warren township was awarded to Haynes & Wayman, Independence, Ind., $11,439.

Corning, Ia.—The contract for constructing 12,000 sq. yds. of brick paving, 189 sq. yds of concrete paving, 4,232 lin. ft. of combined curb and gutters was awarded to Capitol City Concrete Construction Co., Springfield, Ill.

Muscatine, Ia.—The contract for paving 23,283 sq. yds. with bitulithic, 12,648 lin. ft. combined curb and gutter, etc., was awarded to Wm. Horrabin, Iowa City, Ia.

Manhattan, Kan.—The contract for paving 13,350 sq. yds. with brick, asphalt filler, 1,000 ft. 48-in. gutters, 500 ft. 12-in. face curb, 36 headers and 500 sq. ft. of slabs for crossings was awarded to W. W. Cook & Son, Manhattan, Kan.

Wichita, Kan.—The contract for paving 25 blocks with brick and cement and asphalt filler was awarded to John Ritche & Sons, Topeka, Kan., $46,000.

Louisville, Ky.—The following contracts were awarded: Furnishing 200,000 vitrified blocks, to Peebles Paving Brick Co., Portsmouth, O. Furnishing a quantity of vitrified bricks, to Kentucky Vitrified Brick Co., Louisville, Ky.

Crowley, La.—The contract for constructing 8 miles of 4-ft. cement sidewalks was awarded to De Jersey & Bernard, Crowley, La.

Ft. Andrews, Mass.—The contract for constructing roads, walks, gutters, catch-basins and drains was awarded to Thos. Fitzgibbons, Beverly, Mass., $6,630.

Menominee, Mich.—The contract for constructing bay shore road was awarded to Robert Rick, Menominee, Mich., $12,-634.

St. Paul, Minn.—The contract for constructing cement sidewalks was awarded to St. Paul Cement Works, E. 4th st., $30,000.

Atlantic City, N. J.—The contract for paving Albany and Pennsylvania aves. was awarded to United Paving Co., Atlantic City, N. J., $66,157.

Bernardsville, N. J.—The contract for constructing stone roads with asphaltic binder was awarded to A. C. Denahan, Yardley, Pa., $5,070.

New York City, N. Y.—The following contracts were awarded: Improving Muscouta st., to Ames Transfer Co., Kingsbridge ave., Bronx, $41,638; repairing asphalt block pavement, to Harlin Construction Co., 2 Rector st., New York, $43,235.

Akron, O.—The contract for paving 3½ miles Akron-Hudson road was awarded to Pickett & Faust, Martin's Ferry, O., $75,-000.

Cincinnati, O.—The following contracts were awarded: Furnishing 200 tons of asphalt, to Barber Asphalt Co., Cincinnati, O.; 200 tons of Maltha brand, to Union Oil Co., Los Angeles, Cal.

Wapakoneta, O.—The contract for paving Mechanic st. was awarded to J. E. Conley & Co., Dayton, O., $38,065.

Youngstown, O.—The following contracts were awarded: Crosswalks and sidewalk repairs, to Turner & Olsen; paving Griffith st., to Chas. Harris, $6,383; paving Milicent ave., to James McCarron, $10,343; paving Williamson ave., to H. A. Miller; paving Jefferson st., to Joseph P. Morrison, $11,498; paving Hillman st., to J. M. McCraw, $12,424; paving South ave., to Kennedy Bros.; paving Spring Common bridge approaches, to S. H. DeGroodt, Youngstown, O.

Alva, Okla.—The contract for paving 23,000 sq. yds. with Hassam pavement was awarded to Rackliffe Gibson Construction Co., St. Joseph, Mo.

Wilson, Pa.—The contract for paving

Mendelssohn ave. was awarded to Maynard & Flynn, Pittsburg, Pa., $12,173.

Knoxville, Tenn.—The contract for constructing a road in Hamblen county was awarded to French Bros., Knoxville, Tenn., $15,000.

Lynchburg, Va.—The contract for laying tar macadam on Wist st. was awarded to S. B. Bennington, Lynchburg, Va., $16,517.

Spokane, Wash.—The contract for paving, grading and curbing Hamilton st. was awarded to Barber Asphalt Paving Co., Spokane, Wash., $65,448.

Waterville, Wash.—The contract for constructing 9 miles of county road was awarded to J. J. McNerney, Wenatchee, Wash., $38,000.

Hunt, W. Va.—The contract for laying about 8,500 sq. yds. of vitrified brick on various streets was awarded to Louis S. Lawson, Hunt, W. Va., $25,000.

Huntington, W. Va.—The following contracts were awarded: Constructing 38,000 sq. yds. of street pavement, to Harrison & Dean; 46,000 sq. yds., to Freshwater & Son; and 22,000 sq. yds., to Geo. Hinkle, Huntington, W. Va.

Neenah, Wis.—The contract for constructing tar macadam pavement on S. Commonwealth st. was awarded to Christ Johnson, Oshkosh, Wis., $14,000.

## SEWERS.

### CONTEMPLATED WORK.

DeQueen, Ark.—Contemplating the construction of a sewer system to cost about $50,000. W. D. Garrison, mayor.

Terra Bella (Plano P. O.), Cal.—Plans are being prepared for the construction of a sewer system. Engineer Althouse, Porterville, Cal.

Bakersfield, Cal.—Plans are being prepared for sewer construction to cost $25,000.

Berkeley, Cal.—Voted $250,000 bonds for storm sewers.

Corning, Cal.—Plans are being prepared for a complete sewer and water system to cost $70,000. Cy. engr.

San Francisco, Cal.—Water works, sewers and street improvements to cost $3,000,000 are contemplated.

Galva, Ill.—Contemplating the construction of a sewer system. W. S. Shields, cy. engr.

Wapella, Ia.—Plans are being prepared for the construction of 5,000 ft. of 10 to 24-in. pipe sewers. J. G. Keck, cy. recdr.

Nevada, Ia.—Plans have been prepared for the construction of a sanitary sewer and disposal plant, to cost $40,000.

Mansfield, La.—Plans are being prepared for the construction of a sewer system. W. E. Singleton, cy. clk.

Fitchburg, Mass.—Plans are being prepared for the construction of a portion of the main intercepting sewer.

Virginia, Minn.—Bids will soon be requested for the construction of a sanitary sewer.

Carthage, Mo.—Plans have been prepared for the construction of a new sewer district. Frank B. Newton, cy. engr.

Gordon, Neb.—Voted bonds for the construction of a sewer and water works system. Cy. coun.

Nebraska City, Neb.—Plans have been prepared for a sanitary sewer to cost about $80,000. Chas. A. Shannon, cy. engr.

Omaha, Neb.—The contract will soon be let for the construction of brick and concrete main sewers to cost $100,000.

Las Vegas, N. M.—Contemplating the construction of sewer system in various streets. Cy. coun.

Syracuse, N. Y.—Contemplating sewer construction to cost $20,000.

Amherst, O.—Plans are being prepared for the construction of gravity sewers and disposal plant. C. S. Aschenback, clk.

Beach City, O.—Bids will soon be requested for constructing sewers to cost about $13,000. H. B. Ward, cy. clk.

Corey, O.—Plans have been prepared for the construction of a sewer system. C. S. Spencer, cy. clk.

East Palestine, O.—Ordinances have been passed providing for the construction of sewers and paving various streets. O. L. Butts, cy. clk.

New Berlin, O.—The construction of a sewerage and water works system is contemplated. Cy coun.

Steubenville, O.—An ordinance has been passed providing for improvement of sewer in the alley between White Market and Belleview boulevard. Cy. coun.

Rosebury, Ore.—Plans are being preparedd for the construction of a sewer system. Cy. engr.

McKees Rocks, Pa.—An ordinance has been passed providing for the construction of a sewer in Jenk alley.

Pittsburg, Pa.—Improvement of the Try st. sewerage system, to cost $144,000, is contemplated. City Council.

Pleasantville, Pa.—Contemplating the construction of a sewage disposal plant.

Ft. Worth, Tex.—Contemplating the construction of storm sewers to cost about $120,000. W. J. Estes, cy. sec.

Wennewick, Wash.—Voted $20,000 bonds for the construction of a sewer system.

Battleford, Alberta, Can.—The construction of a sewerage system is contemplated.

### CONTRACTS TO BE LET.

Clinton, Ia.—Bids will be received April 4 for constructing lateral sewers consisting of 2,543 ft. of 10- to 36-in. pipe sewer, 14,800 cu. yds. rock excavation, 76 manholes, 62 catch basins, 122 inlet basins. W. E. Hayes, cy. clk.

Brainard, Minn.—Bids will be received until April 17, 1 p. m., for constructing sewers. V. N. Broderick, cy. clk; certified check 15 per cent.

South Orange, N. J.—Bids will be received until April 11 for constructing 18,618 ft. of 8 to 12-in. sanitary sewers, 59 manholes, 4 flush tanks. Certified check, $5,000. Edward Arcularius, town clk.

East Aurora, N. Y.—Bids will be received until April 18, 8 p. m., for furnishing material and constructing a sewer system and sewage disposal plant. Certified check 2 per cent. Bd. trus., D. N. Rumsey, clk.

Amherst, O.—Bids will be received until April 20 for constructing sewage disposal plant and a sewer system. City council.

Berea, O.—Bids will be received until April 24 for furnishing material and constructing a sewer in Waite st., including manholes, etc. Certified check, $100. O. R. Stone, clk.

Cleveland, O.—Bids will be received until April 5 for constructing sewer system. John Goldenbogen.

Youngstown, O.—Bids will be received until April 10 for sewer construction. Certified check, $300. James E. Sottler, cy. clk.

Chambersburg, Pa.—Bids will be received until April 10, 8 p. m., for constructing a system of sanitary sewers, a main outfall sewer and sewage disposal plant, consisting of the following: 84,700 ft. of from 8 to 24-in. terra cotta pipe, manholes, Y branches and accessories.

460 cu. yds. concrete or retaining walls, 1,400 ft. of 20 to 30-in. concrete sewer, 72 ft. 24 in. cast iron pipe, 900 ft. 16-in. force main, 960 ft. 12-in. cast iron siphon line, 1 pump house and collecting valve, equipped with three electric-driven centrifugal pumps, capacity 1,000 gal. per min.; 5 concrete settling tanks, 1 sprinkling filter bed, 160 ft. by 125; 1 sand filter for sludge, grading and other work. Certified check, 5 per cent. S. K. Shryock.

Moose Jaw, Sask., Can.—Bids will be received until April 10 for furnishing and laying about 30,700 lin. ft. tile pipe sewer, manholes, etc. W. F. Heal, cy. clk.

Saskatoon, Sask., Can.—Bids will be received until April 14 for furnishing material and constructing intercepting sewer. James Clinkskill, mayor.

#### CONTRACTS AWARDED.

Calexico, Cal.—The contract for constructing sewer system was awarded to Watson & Spicer, Colorado Springs, Colo., for $26,600.

Fresno, Cal.—The constract for constructing main sewers was awarded to Jos. House, Fresno, Cal., for $37,900.

San Francisco, Cal.—The contract for constructing sewers in Section B of Sunnyside sewer was awarded to F. Rolandi, 550 Montgomery st., San Francisco, Cal., for $59,403.

Turlock, Cal.—The contract for sewer construction was awarded to E. E. Paxson, Turlock, Cal., for $8,668.

Washington, D. C.—The contract for constructing various sewers was awarded to Warren T. Brenizer Construction Co., Washington, D. C., for $13,745.

Atlanta, Ga.—The following contracts were awarded: Constructing the Intrenchment creek disposal plant, to Chester A. Dady, New York City, N. Y., for $171,818; constructing intercepting sewer, to Moll Construction Co., Atlanta, Ga., for $65,663; constructing DuBois aqueduct, to Nichols Construction Co., for $7,170; constructing the Collier aqueduct, to Mackle-Crawford Co., for $7,400; constructing the Parker aqueduct, to Dysard Construction Co., for $5,400.

Pocatello, Ida.—The contract for furnishing material and constructing sewer system was awarded to R. M. Bardsen & Co., Pocatello, Ida., for $69,493.

Bement, Ill.—The contract for constructing storm sewer system was awarded to Arthur Bert, Decatur, Ill., for $22,145.

LaGrange, Ill.—The contract for constructing an outlet sewer was awarded to H. McNichols, 217 LaSalle st., Chicago, Ill., for $95,107.

Paris, Ill.—The contract for furnishing and laying about 4,544 ft. 36 and 60-in. reinforced concrete or brick sewer, including 10 manholes, was awarded to Frank Payne, Paris, Ill., for $14,980.

Rock Island, Ill.—The contract for constructing Seventh ward sewer was awarded to D. Keeler Co., Davenport, Ia., for $55,697.

Elkhart, Ind.—The contract for constructing one mile of pipe sewers was awarded to Frank J. Miller, Elkhart, Ind., for $6,782.

Mt. Vernon, Ia.—The contract for constructing tower and outlet sewers, for $22,106.75, and septic tank and dosing chamber and filter beds, for $6,486.82, was awarded to Henning-Vineyard Co., Evansville, Ind.

Sac City, Ia.—The contract for sewer construction was awarded to Lytle Construction Co., Sioux City, Ia., for $5,205.

Sigourney, Ia.—The contract for constructing sanitary sewers was awarded to Bash & Gray, Joplin, Mo., for $39,741.

Baltimore, Md.—The following contracts were awarded: Laying trunk sewer in Pratt st., to McCoy Engineering Co., Baltimore, Md., for $85,751; lateral sewers in district No. 15, to William McCortley & Co., Baltimore, Md., for $75,187.

Niles, Mich.—The contract for constructing a main trunk sewer in various streets was awarded to Heystek Co., Kalamazoo, Mich., for $18,879.

St. Paul, Minn.—The contract for constructing storm sewer on Grove st. was awarded to John Lind, St. Paul, Minn., for $12,500.

Sedalia, Mo.—The contract for constructing South-East Sedalia sewer and septic tank was awarded to W. E. Hall, Clinton, Mo., for $40,000.

Tracy, Minn.—The contract for sewer construction was awarded to G. S. Redmon, Pipestone, Minn., for $5,500.

Kansas City, Mo.—The contract for constructing storm water sewer, to extend from Winchester ave. to Blue river, was awarded to Michael Walsh, Kansas City, Mo.

Jamaica, L. I., N. Y.—The contract for constructing sewer in Liberty and Stoothoff aves. was awarded to Litchfield Construction Co., Jamaica, L. I., N. Y., for $51,395.

Canton, O.—The contract for constructing storm water sewer was awarded to Calvin Turnbull and Joseph Delm, Canton, O., for $25,528.

Cleveland, O.—The contract for constructing a portion of the West 25th st. main sewer was awarded to William Lehmann, Cleveland, O., for $28,107.

Niles, O.—The contract for constructing main trunk sewer was awarded to C. H. Defrees, South Bend, Ind., for $22,000.

Erie, Pa.—The following contracts were awarded: Constructing a sewer in Cranberry st., to J. & M. Doyle, Erie, Pa.; Mill creek intercepting sewer, to V. D. Eichenlaub, Erie, Pa., $10,415.

Charleston, S. C.—The contract for sewer construction was awarded to Guild & Co., Chattanooga, Tenn., for $51,639.

Dallas, Tex.—The contract for laying a storm sewer in Columbia ave. was awarded to Dallas Lime and Gravel Co., Dallas, Tex., for $9,097.

Moundsville, W. Va.—The contract for constructing sewerage system was awarded to B. F. Sweeten & Son, Camden, N. J., for $121,180.

Milwaukee, Wis.—The contract for constructing sanitary sewers was awarded to Mullholland & Son, Kaukauna, Wis., for $9,062.

## WATER WORKS.

#### CONTEMPLATED WORK.

Huntsville, Ala.—Contemplating the construction of a purification plant for the water works system. City council.

Corning, Cal.—Plans are being prepared for a complete sewer and water system to cost $70,000. Cy. engr.

Dorris, Cal.—Contemplating the construction of a municipal water works.

San Luis Obispo, Cal.—Plans have been prepared for the construction of a 5,700,000-gallon earthen reservoir.

San Francisco, Cal.—Water works, sewers and street improvements to cost $3,000,000 contemplated.

Ft. Lupton, Colo.—Contemplating the construction of water works system .

St. Petersburg, Fla.—Contemplating the construction of a reservoir. Water works com.

Titusville, Fla.—Voted $30,000 bonds for construction of water works. City council.

Pelham, Ga.—Contemplating water works improvements. City council.

New Athens, Ill.—Plans are being prepared for water works system to cost about $28,000.

Evansville, Ind.—Contemplating the installation of a water works pump to cost about $10,000. Bd. pub. wks.

Monticello, Ind.—Improvements to the water works are contemplated. Bd. pub. wks.

Canton, Kan.—Plans are being prepared for the construction of water works system. C. M. Gray, cy. clk.

Luray, Kan.—Voted $20,000 bonds for water works construction. P. E. Moss, cy. clk.

Owensboro, Ky.—Plans have been prepared for the construction of a water softening plant.

Mingo, Ky.—Contemplating the construction of a water works system.

Butterfield, Minn.—Contemplating the construction of a water works system. City council.

Moberly, Mo.—The construction of about 8,000 ft. of 6-in. water main is contemplated. S. McDonald, cy, engr.

Gordon, Neb.—Voted bonds for the construction of sewer and water works system. City council.

Morrill, Neb.—Information is requested for prices, etc., on pumping plants for irigation. A lift of 10 to 30 ft. contemplated, to irrigate about 1,000 acres. H. A. Mark, Morrill, Neb.

Albuquerque, N. Mex.—The laying of water mains in various streets is contemplated.

Jamestown, N. Y.—Contemplating the construction of a storage reservoir with a capacity of 15,000,000 gallons.

Mount Morris, N. Y.—Voted $100,000 bonds for water works construction.

Syracuse, N. Y.—Contemplating the expenditure of $25,000 for water works improvements.

Canton, O.—An ordinance has been passed providing for water works improvements, including a reservoir to cost $40,000.

New Berlin, O.—The construction of a sewerage and water works system is contemplated. City council.

Springfield, O.—Contemplating the extension of water mains. City council.

Stonewall, Okla.—Voted $30,000 bonds for water works construction.

Schuylkill Haven, Pa.—Voted $50,000 bonds for the construction of an additional reservoir.

Rusk, Tex.—Voted $18,000 bonds for water works construction.

Park City, Utah.—Plans have been prepared for the construction of a water works system.

Marcus, Wash.—Contemplating the construction of water works and electric system.

Battleford, Alberta, Can.—The construction of water works is contemplated.

Welland, Ont.—Voted $52,000 bonds for water works construction.

### CONTRACTS TO BE LET.

Ft. Baker, Cal.—Bids will be received until April 4 for constructing pump house, installing machinery, laying water mains and erecting steel water tank. Maj. Geo. McK. Williamson, Ft. Mason, Cal.

Ft. McKinley (Portland P. O.), Me.—Bids will be received until April 15 for constructing and installing a chemical water softening plant of 15,000 gals. capacity per hour. Capt. Joseph F. Gohn, Portland, Me.

Helena, Mont.—Bids will be received until April 20 for constructing water works reservoir pipe line and distributing system. J. A. Mattson, cy. clk.

Keeseville, N. Y.—Bids will be received until April 5 for laying cast iron pipe and constructing a reservoir and standpipe, etc. Bd. wat. comrs.

Cleveland, O.—Bids will be received until April 4 for furnishing material and constructing an elevated steel water tower. Certified check, $1,000. E. R. Lieblein, clk.

Ada, Okla.—Bids will be received until April 15 for constructing water works. Estimated cost, $140,000. W. B. Jones, cy. clk.

Galveston, Tex.—Bids will be received until April 3 for furnishing material and constructing about 10,766 lin. ft of 30-in. water main. Certified check, 5 per cent. Bd. of cy. comrs. John D. Kelley, cy. sec.

Moose Jaw, Sask., Can.—Bids will be received until April 10 for furnishing and laying about 29,700 lin. ft. cast iron water main. W. F. Heal, cy. clk.

Rouleau, Sask., Can.—Bids will be received until April 4 for furnishing pumping and electrical machinery, producer gas plant, cast iron or steel water mains, valves, etc. W. H. Stewart, cy. sec.

### CONTRACTS AWARDED.

Alameda, Cal.—The contract for furnishing a new boiler for the municipal electric plant was awarded to Risdon Iron Works, San Francisco, Cal., for $5,585.

Ontario, Cal.—The following contracts were awarded: Laying water pipes, to Joe Clintok, Los Angeles, Cal., for $18,882; screw pipe and specials, to Cram Co., Los Angeles, for $70,375; riveted pipe and specials, to Western Pipe and Steel Co., Los Angeles, Cal., for $16,398.

San Francisco, Cal.—The contract for furnishing, testing and delivering gate and check valves, was awarded to Union Machine Co.; bolts, tie rods, etc., for water system, to Union Iron Works, San Francisco, Cal.

Turlock, Cal.—The contract for water works improvements was awarded to William Heafly, San Francisco, Cal., for $16,431.

Dalton, Ga.—The contract for constructing reinforced concrete reservoirs and filters was awarded to John W. Ash, Austell, Ga., $16,500.

Apple River, Ill.—The contract for constructing water works was awarded to T. H. Iglehart, Chicago, Ill., for $15,400.

Chicago, Ill.—The contract for furnishing and installing two electrically driven centrifugal pumps was awarded to Platt Iron Works, Dayton, O., for $53,940.

Joliet, Ill.—The contract for furnishing pumping machinery for artesian well was awarded to Hill-Tripp Pump Co., Anderson, Ind., for $5,985.

Adair, Ia.—The contract for constructing a combined electric light and water works plant was awarded to Des Moines Bridge and Iron Co., Des Moines, Ia., for $28,469.

Corydon, Ia.—The contract for water

works construction was awarded to Bash & Gray, Joplin, Mo., for $26,892.

Jefferson, Ia.—The contract for water works construction was awarded to C. W. Roland & Co., Des Moines, Ia., for $6,200.

Iola, Kan.—The contract for installing three new boilers was awarded to United Iron Works, Iola, Kan., for $6,844.

Fall River, Mass.—The contract for furnishing 172,000 ft. of 6 to 12-in. water pipe was awarded to R. D. Wood & Co., 400 Chestnut st., Philadelphia, Pa.

Minneapolis, Minn.—The following contracts were awarded: Fnrnishing 250 tons of special castings, to Diamond Iron Works, Minneapolis, Minn.; 1,000,000 red sand sewer brick, to Wisconsin Red Pressed Brick Co., Minneapolis, Minn.; sewer pipe, to Red Wing Sewer Pipe Co., Minneapolis, Minn., for $65,900.

Two Harbors, Minn.—The contract for installing pump at water works was awarded to La Vasque & Webster, Duluth, Minn., $11,042.

Bozeman, Mont.—The contract for enlarging reservoir was awarded to S. Birch & Sons Construction Co., Bozeman, Mont., for $6,972.

Great Falls, Mont.—The contract for furnishing 135 tons of 12-in. water pipe and specials was awarded to American Cast Iron Pipe Co., Birmingham, Ala.

Hurlowtown, Mont.—The following contracts were awarded: Constructing a reservoir, capacity 250,000 gals, and furnishing and laying 3,550 ft. 8-in. and 400 ft. 6-in. water mains, with hydrants, valves, etc., to R. M. Bordsen, Butte, Mont., for $7,800.

Townsend, Mont.—The contract for constructing water works was awarded to W. D. Lovell, Minneapolis, Minn., for $24,778.

Buffalo, N. Y.—The contract for furnishing 3 steam turbine electric generators for pumping station was awarded to Westinghouse Electric Co., Buffalo, N. Y., for $240,000.

Fort Terry, N. Y.—The contract for constructing a 200,000-gal. reinforced concrete reservoir was awarded to Connecticut Engineering Co., Norwich, Conn., for $6,750.

Hornell, N. Y.—The contract for constructing an earthen reservoir embankment, with concrete core wall and all accessories was awarded to Gary & Miller, Hornell, N. Y., for $39,420.

Canton, O.—The contract for constructing a 1,000,000-gal. reservoir was awarded to Chicago Bridge and Iron Co., Chicago, Ill., for $23,000.

Cincinnati, O.—The contract for laying water main in North Bend road, from Cheviot to College Hill, was awarded to J. J. Brown, Cincinnati, O., for $14,274.

Toledo, O.—The contract for constructing extensions to water purification plant was awarded to Norwood Engineering Co., Florence, Mass.

Zanesville, O.—The contract for constructing water works system was awarded to National Co., South Bend, Ind., for $62,164.

Haskell, Okla.—The contract for constructing water works was awarded to F. R. Stone, Haskell, Okla., for $28,200.

Hamilton, Tex.—The contract for furnishing 9,000 ft. of cast iron pipe, valves, etc., was awarded to American Cast Iron Pipe Co., Birmingham, Ala.

Temple, Tex.—The following contracts were awarded: Furnishing equipment for filtration plant, to Pittsburg Filter Co., Pittsburg, Pa.; construction work to W. C. Rittiger, Belton, Tex. Total cost, $27,190.

Ogden, Utah.—The contract for constructing a conduit from Cold Water canyon to city reservoir was awarded to J. P. O'Neil Construction Co., Ogden, Utah, for $67,463.

White Bluffs, Wash.—The contract for furnishing 50,000 ft. 12-in. wood standpipe was awarded to Pacific Pipe and Tank Co., Portland, Ore.

Sparta, Wis.—The contract for furnishing 1,500,000-gal. high duty pumping engine was awarded to Allis-Chalmers Co., Milwaukee, Wis., for $6,950.

Sheridan, Wyo.—The contract for installing water works system was awarded to Jas. Kennedy Contracting Co., Fargo, N. D., for $30,000.

Winnipeg, Man.—The contract for constructing a 1,000,000-gal. reservoir was awarded to I. Benoit, St. Boniface, Man., for $32,000.

## BRIDGES.

### CONTEMPLATED WORK.

Warren, Ark.—Contemplating the construction of a bridge across the Saline river at Reddings Ferry.

Los Angeles, Cal.—Contemplating the construction of a bridge across the Arroyo Seco at Garvanza, to cost $150,000.

Modesto, Cal.—Contemplating the construction of a bridge to cost $15,000 to replace one destroyed by high water.

Stockton, Cal.—Contemplating the construction of 25 bridges and culverts. R. M. Morton, highway engr.

Denver, Colo.—Contemplating the construction of a bridge over Platte river at Alameda ave., to cost about $49,000. J. B. Hunter.

Washington, D. C.—Plans have been prepared for the construction of a bridge across Rock creek, to cost $275,000.

Vinton, Ia.—Contemplating the construction of a number of concrete bridges and culverts. County comrs.

Valencia, Kan.—Contemplating repairing the bridge over Kansas river, to cost about $15,000.

Boston, Mass.—Plans are being proposed for the construction of a steel bridge to cost $125,000.

Lynn, Mass.—Plans are being prepared for the construction of a steel bridge over the Sangus river. W. Moody co. comr.

Baraga, Mich.—The construction of a steel bridge, 163 ft. long, to span the Sturgeon river, is contemplated.

Saginaw, Mich.—Contemplating the construction of a bridge 600 ft. long, to cost about $85,000. R. W. Roberts, cy. engr.

Rolla, Mo.—Contemplating the construction of a steel bridge across the Little Piney river, south of Newbury.

Virginia City, Mont.—The construction of a bridge over Jefferson river, near Silver Star, is contemplated. County comrs.

Claremore, Okla.—Contemplating the construction of 5 new bridges in Rogers Co. Co. clk.

Jacksonville, Ore.—Plans have been prepared for the construction of a bridge over Rogue river, at Gold Hill.

Fulton, N. Y.—Contemplating the construction of a concrete bridge, 50 ft. wide, with steel reinforcements, to cost about $170,000.

Syracuse, N. Y.—Contemplating the construction of a bridge to cost $80,000.

Chester, Pa.—Contemplating the construction of a bridge over Doe Run creek, near Springdale, in Chester Co.

Kittanning, Pa.—Contemplating the construction of a bridge over Rough run, near Winfield.

Pittsburgh, Pa.—Bids will soon be requested for the construction of the piers of the new Point bridge. Estimated to cost about $210,000. Bd. pub. wks.

Burnet, Tex.—Contemplating the construction of a bridge across the Colorado river. Co. comrs.

Menardville, Tex.—Contemplating the construction of a steel bridge across the San Saba river, to cost $20,000. Co. comrs.

Brigham, Utah.—Bids will soon be requested for the construction of a bridge over Box Elder canyon. Co. comrs.

Richfield, Utah.—The construction of a bridge over the Sevier river, between Redmond and Salina, is contemplated.

Milwaukee, Wis.—The construction of a pontoon bridge across the Milwaukee river at Oneida street is contemplated.

CONTRACTS TO BE LET.

Auburn, Cal.—Bids will be received until April 4 for constructing a steel bridge across the North Fork of American. Bd. of Supervisors, Placer Co., Cal.

Mackay, Ida.—Bids will be received until April 8 for constructing a steel bridge across Salmon river. Bd. cy. comrs.

Brazil, Ind.—Bids will be received until April 4 for constructing a bridge at Clay City. Edgar A. Stags, audt.

Ida Grove, Iowa—Bids will be received until April 3 for plans and construction of steel bridges in Ida Co. Bd. of supervisors.

Lagrange, Ind.—Bids will be received until April 5 for constructing 5 concrete and iron bridges and one wooden pile bridge. C. S. Willard, audt.

Rockport, Ind.—Bids will be received until April 5 for constructing 25 bridges. John T. White, audt.

Shelbyville, Ind.—Bids will be received until April 5 for constructing 4 reinforced concrete bridges. G. B. Huntington, audt.

Vincennes, Ind.—Bids will be received until April 8, 10 a. m., for constructing 3 bridges in Knox Co. John T. Scott, audt.

Clinton, Ia.—Bids will be received until April 11 for constructing a concrete steel culvert or bridge at waterway on 4th and Lumber sts. Bond $500 required. W. E. Hayes, cy, clk.

Hill City, Kan.—Bids will be received until April 4, 12 m., for constructing a bridge. Ben S. Smith, co. clk.

Cando, N. D.—Bids will be received until April 4 for constructing 150 ft. more or less of steel and concrete bridge. Certified check, $500. Frank Shanley, audt.

Xenia, O.—Bids will be received until April 12, 11:30 a. m., for constructing superstructure and approaches of the Louis Hill bridge. Board county commissioners.

Allentown, Pa.—Bids will be received until April 3 for repairing five wooden bridges. Board of commissioners.

Chambersburg, Pa.—Bids will be received until April 14 for constructing a reinforced concrete bridge over Muddy run at Rankin's Mill in Antrim township. Certified check, $500. E. K. Raff, clk.

Reading, Pa.—Bids will be received until April 4 for constructing 3 reinforced concrete bridges. County commissioners.

Kingston, Ont.—Bids will be received until April 5 for constructing the Catassaqui Bridge to cost about $18,000. H. B. R. Craig, cy. engr.

Minnitonas, Man.—Bids will be received until April 15 for furnishing and erecting a Warren truss steel bridge and two concrete piers. E. Widmeyer, secy.

Swan River, Man.—Bids will be received until April 15 for erecting a 94-ft. steel riveted Pratt truss bridge over Wood river. Joseph Armstrong, secy.

Winnipeg, Man.—Bids will be received until April 15 for constructing a 94-ft. steel riveted Pratt truss bridge. Municipal council. Joseph Armstrong, secy.

CONTRACTS AWARDED.

Corona, Cal.—The contract for constructing concrete piers on two bridges was awarded to Newton Construction Co., San Diego, Cal.

Fairmount, Ill.—The contract for constructing a bridge over Salt Fork river, was awarded to R. C. Spandau, Danville, Ill., $6,995.

Morris, Ill.—The contract for constructing a bridge over the stream between sections 23 and 24 in Grundy co., was awarded to Joliet Bridge & Iron Co., Joliet, Ill.

Greenfield, Ind.—The contract for constructing bridges in Hancock county, was awarded to Greenfield Bridge & Sewer Co., Greenfield, Ind.

Laporte, Ind.—The contract for constructing 3 iron bridges, was awarded to Rochester Bridge Co., Rochester, Ind.; constructing concrete abutments, was awarded to William A. Steigely, Laporte, Ind.

Waterloo, Ia.—The contract for constructing a 60-ft. extension to the east approach of the city bridge, was awarded to Retzinger, Waterloo, Ia.

Waverly, N. Y.—The contract for bridge construction was awarded to Climax Road Construction Co., Marathon, N. Y., $17,797.

Graham, Tex.—The contract for constructing bridge across Brazos river in Young county, to have four 185-ft. steel spans, 16-ft. road and concrete piers, etc., was awarded to M. S. Hasie, Jr., Dallas, Tex., $17,000.

Spokane, Wash.—The contract for construction of a reinforced concrete bridge over Latah creek, was awarded to C. F. Graff, Seattle, Wash., $42,900.

Menominee, Wis.—The contract for bridge construction, was awarded to Wausau Iron Co., Menominee, Wis., $24,468.

## STREET LIGHTING.

CONTEMPLATED WORK.

Albertsville, Ala.—Voted $7,000 bonds for the construction of an electric light plant.

Albany, Ga.—Contemplating the construction of a gas plant. City council.

Doerum, Ga.—Voted $15,000 bonds for the construction of an electric light plant.

Pelham, Ga.—Contemplating lighting plant improvements. City council.

Ft. Wayne, Ind.—Contemplating installing tungsten or magnetite system of illumination on Calhoun st.

Canton, Kan.—Plans are being prepared for the construction of an electric light plant. C. M. Gray, cy. clk.

Kansas City, Kan.—Voted $350,000 bonds to purchase and construct a municipal electric light plant.

Spearville, Kan.—Contemplating the construction of an electric light plant.

Jeffersontown, Ky.—Contemplating the installation of a lighting plant to cost about $15,000.

Sterling, Mass.—The installation of an electric light system is contemplated.

Hillsdale, Mich.—Contemplating the construction of an electric light system.

Clinton, Minn.—Contemplating the installation of an electric light plant.

Tylertown, Miss.—Contemplating the construction of a lighting system.

Franklin, Neb.—Voted $8,000 bonds for the construction of an electric light plant. W. E. Donner, Grand Island, engr.

Gordon, Neb.—Voted bonds for the installation of an electric light plant. City council.

O'ean, N. Y.—Contemplating the construction of a municipal lighting plant. Geo. M. Lundry, cy. clk.

Akron, O.—Contemplating the construction of a municipal electric light plant.

Dalles, Oreg.—Contemplating the construction of an electric light plant.

Hazeldell, Pa.—The construction of a municipal electric light plant is contemplated.

Royersford, Pa.—Contemplating the construction of a municipal electric light plant.

Draper, S. D.—Contemplating the installation of an electric light plant.

Hayti, S. D.—The installation of an electric light plant is contemplated.

Miller, S. D.—Contemplating the installation of a new 100-h. p. boiler and tungsten street lighting system.

Big Sandy, Tenn.—The construction of an electric light plant is contemplated.

Shelbyville, Tenn.—Contemplating installing a municipal electric light plant.

Brownsville, Tex.—Voted $15,000 bonds for extending electric light plant.

Marcus, Wash.—Contemplating the construction of water works and electric light system.

White Bluffs, Wash. — Contemplating the installation of an electric lighting system.

Baraboo, Wis.—Plans have been prepared for the construction of an electric light plant, to cost $45,000.

#### CONTRACTS TO BE LET.

Eveleth, Minn.—Bids will be received until April 4 for furnishing ornamental street lights for 6 blocks. D. P. McIntyre, cy. clk.

Omaha, Neb.—Bids will be received until April 11 for lighting streets for periods of both 3 and 5 years. City council.

Cincinnati, O.—Bids will be received until April 3 for lighting by electricity the streets, lands, lanes and squares and public places for a period of ten years. Certified check, $100,000. John J. Wenner, clk.

#### CONTRACTS AWARDED.

Phoenix, Ariz.—The following contracts were awarded: furnishing * motors and transformers to Wagner Electric Mfg. Co., St. Louis, Mo., $7,778; furnishing switchboards, to Westinghouse Electric & Mfg. Co., Chicago, Ill., $1,411.

Staunton, Ill.—The contract for installing electrical apparatus in municipal electric light plant was awarded to Wesco Supply Co., St. Louis, Mo., $6,725.

Adair, Ia.—The contract for constructing a combined electric light and water works plant, was awarded to Des Moines Bridge & Iron Co., Des Moines, Ia., $28,469.

Annapolis, Md.—The contract for furnishing electric current for lighting various sections of the city for five years, was awarded to Consolidated Gas & Electric Light Co., Baltimore, Md.

West Caldwell, N. J.—The contract for furnishing electric light for 3 years, was awarded to Public Service Electric Co., West Caldwell, N. J.

Yonkers, N. Y.—The contract for lighting streets for five years, was awarded to Westchester Lighting Co., Yonkers, N. Y.

Coraopolis, Pa.—The following contracts were awarded for furnishing machinery for municipall electric light plant: One 225-h. p. engine, to Buckeye Engine Co.; two engines, one 150-h. p. and the other 175-h. p., to Cruthers Wells Co.; three generators, to Crocker Wheeler Co.; and for a switchboard, to Westinghouse Electric Co., Coraopolis, Pa.

## GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

#### CONTEMPLATED WORK.

Lexington, Ky.—Bids will soon be requested for sweeping and cleaning all the improved sts. in the city, and furnishing and spreading 170,000 gallons of Ragland oil on the macadam sts. Board public works.

Cincinnati, O.—Contemplating the construction of a municipal reduction plant. Mayor Schwab.

Erie, Pa.—Charles Carroll Brown, consulting engr., 407 Commercial Club Bldg., Indianapolis, Ind., has been engaged to prepare plans and specifications for the construction of a garbage disposal plant to cost $52,000.

Seattle, Wash.—Contemplating the construction of a garbage incinerator to cost about $125,000.

Milwaukee, Wis.—The purchase of four flushing machines for street cleaning, is contemplated. J. J. Handley, supt.

Racine, Wis.—The construction of a Decarie garbage incinerator has been recommended by the special committee appointed for that purpose.

#### CONTRACTS AWARDED.

Waterbury, Conn.—The contract for collecting garbage for the year, was awarded to Hans Rassmussen, Waterbury, Conn., $12,000.

Cloquet, Minn.—The contract for furnishing a chemical fire engine, was awarded to W. S. Nott Co., Cloquet, Minn.

Fort Omaha, Neb.—The contract for constructing a garbage crematory, was awarded to Morse Boulger Destructor Co., 39 Cortlandt st., New York City, N. Y.

Schenectady, N. Y.—The contract for furnishing three new machines for sweeping streets, to Austin Western Co., Schenectady, N. Y.

## FIRE APPARATUS.

#### CONTEMPLATED WORK.

Riverside, Cal.—The purchase of double jacket 3½-in. rubber-lined fire hose is contemplated.

Ansonia, Conn.—The purchase of a combination truck is contemplated.

Terryville, Conn.—Contemplating the purchase of a chemical engine, truck and fire hose and will establish and equip a fire department.

Brunswick, Ga.—The purchase of an auto truck is contemplated.

Belvidere, Ill.—Contemplating the purchase of an auto truck.

Bloomington, Ill.—The purchase of an auto truck is contemplated.

Waukegan, Ill.—The purchase of an auto truck has been recommended by the water committee.

Brunswick, Me.—The purchase of fire hose is contemplated.

Andover, Mass.—The purchase of a motor chemical is contemplated.

Bridgewater, Mass.—The purchase of fire hose is contemplated.

Cambridge, Mass.—The purchase of an auto chemical and hose truck is contemplated.

Chicopee, Mass.—The purchase of auto fire apparatus is contemplated.

Easthampton, Mass.—The board of engineers have recommended the purchase of an auto chemical and hose wagon.

Leominster, Mass.—The purchase of an auto chemical and hose wagon is contemplated.

Monson, Mass.—Contemplating the purchase of a motor-driven combination truck.

Saugus, Mass.—Contemplating the purchase of a combination chemical wagon.

Wakefield, Mass.—The purchase of an auto fire engine has been recommended by Chief Chase.

Weymouth, Mass.—The purchase of an auto combination chemical wagon is contemplated.

Flint, Mich.—The purchase of an aerial truck is contemplated.

Minneapolis, Minn.—The purchase of a high-speed emergency chemical and hose wagon is contemplated.

Anaconda, Mont.—Contemplating the purchase of more fire hose.

Hinsdale, N. H.—The purchase of fire hose is contemplated.

Long Branch, N. J.—The purchase of a fire engine is contemplated.

Millville, N. J.—The purchase of 1,000 ft. of fire hose is contemplated. Chief Ludlam.

Newark, N. J.—The purchase of another fire truck is contemplated.

Nutley, N. J.—The purchase of an auto truck is contemplated.

Phillipsburg, N. J.—Contemplating the purchase of a chemical engine.

Union, N. J.—The purchase of 1,000 ft. of fire hose, is contemplated. Robert Bond, fire chief.

Sea Cliff (L. I.), N. Y.—The purchase of a chemical fire engine is contemplated.

Seneca Falls, N. Y.—The purchase of a fire hose wagon is contemplated.

Cincinnati, O.—Bids will soon be requested for furnishing an auto fire engine.

Cleveland, O.—Contemplating the purchase of auto hose trucks with turrets for high pressure work. Chief Wallace.

Lorain, O.—Contemplating the purchase of an auto apparatus.

Mansfield, O.—The purchase of an auto combination chemical and a chief's auto, is contemplated. Chief Geo. Koffiock.

Warren, O.—An ordinance to issue bonds for the purchase of an auto combination hose and ladder truck and chemical fire engine has been passed. City council.

Astoria, Ore.—Contemplating the purchase of an auto chemical 800 gallons engine and pumping engine, combination chemical tank, two fire tugs, etc. Chief C. E. Foster.

Erie, Pa.—The purchase of motor trucks and fire engines is contemplated.

Hatboro, Pa.—Contemplating the purchase of a chemical fire engine.

Pawtucket, R. I.—The purchase of a gasoline motor fire engine is contemplated.

Woonsocket, R. I.—The purchase of an auto fire engine is contemplated.

Charleston, S. C.—The purchase of an auto combination chemical and hose wagon has been recommended by Chief Behrens.

Salt Lake City, Utah—Contemplating the following: A triple combination auto, hose pump and chemical for general service; water tower not less than 75 ft., equipped; three new hose companies be organized and equipped; all hose wagons to be rubbed-tired and that 35-gallon extinguishers be placed on all hose wagons and trucks, except aerial trucks; to buy 2½-in. hose up to 25,000 ft.; to install 6 additional alarm boxes, and to build 2 12x16-ft. cisterns in the business district.

Montpelier, Vt.—Contemplating the purchase of a chemical engine.

Aberdeen, Wash.—Contemplating the purchase of a fire-tug.

Racine, Wis.—The purchase of a truck and fire hose has been recommended by Chief Cape.

Ottawa, Ont.—Contemplating the purchase of auto equipment.

### CONTRACTS TO BE LET.

Los Angeles, Cal.—Bids will be received until April 3 for furnishing a motor-propelled aerial hook and ladder truck. Lorin A. Handley, cy. clk.

Paterson, N. J.—Bids will be received until April 21 for furnishing auto hook and ladder outfit and converting 2 first-class fire engines into gasoline-propelled vehicles. E. M. Updike.

Princeton, N. J.—Bids will be received until July 5 for furnishing auto pumping engine. E. M. Updike, chr. fire and water commission.

New York, N. Y.—Bids will be received until April 3 for furnishing and delivering two 75-ft. aerial hook and ladder trucks. R. Waldo, fire commissioner.

Tacoma, Wash.—Bids will be received until April 6 for furnishing a third-size fire engineee. L. W. Roys, commissioner public service.

### CONTRACTS AWARDED.

Hartford, Conn.—The contract for furnishing auto combination car and auto for officers of fire department, was awarded to Pope Mfg. Co., Hartford, Conn.

Washington, D. C.—The contract for furnishing an auto combination enginee, chemical hose cart and truck, was awarded to Watrous Engine Works Co., St. Paul, Minn., $6,950.

Millville, N. J.—The following contracts were awarded: furnishing 500 ft. fire hose, to Eureka Fire Hose Co., Boston, Mass.; 500 ft. to New Jersey Car Spring and Rubber Co., Jersey City, N. J.

Perth Amboy, N. J.—The contract for furnishing third-class steamer and combination hose and chemical wagon, was awarded to American La France Engine Co., Elmira, N. Y., $8,425.

White Plains, N. Y.—The contract for furnishing Locomobile Combination auto chemical and hose wagon, was awarded to Chas. Paul, White Plains, N. Y., $6,000.

Pawtucket, R. I.—The contract for furnishing an auto fire apparatus, was awarded to Webb Fire Apparatus Co., St. Louis, Mo.

Columbia, S. C.—The contract for furnishing auto hose wagon and chemical engine and auto fire enginee, was awarded to Webb Co. and American La France Co., Elmira, N. Y.